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**OPTIMIZING WARTIME MATERIEL DELIVERY:
AN OVERVIEW OF DOD CONTAINERIZATION**

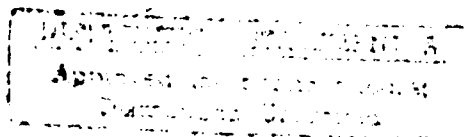
**VOLUME I
PAST EFFORTS AND CURRENT ISSUES**

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SUMMARY

This report presents the findings of a study conducted by the Transportation Systems Center (TSC), Research and Special Programs Administration, U.S. Department of Transportation (DOT), on containerization in the wartime Department of Defense logistics system. TSC was tasked to undertake the study by the Strategic Mobility Division of the Logistics Directorate of the Organization of the Joint Chiefs of Staff (OJCS, J-4).

The use of containers for both peacetime and wartime movements of military supplies and equipment has received considerable attention since the Vietnam era. Two interconnected reasons explain this. First, containerization based on internationally agreed standards dominates international trade, particularly on developed trade routes. The commercial viability and hence the availability of militarily useful (non-container) ships has dropped precipitously in the U.S. and allied merchant fleets. The makeup of the available fleets forces large-scale deployments to depend on non-self-sustaining containerships for a large proportion of the lift.

Second, dependence on containerization has been and continues to be a two-edged sword for DOD. There are substantial and generally well-recognized benefits to DOD as a shipper using containers. These benefits include lower cost, decreased shipping time and improved cargo protection/security. However, containerships are not ideal military assets. They require continued access to well developed ports and supporting infrastructure for their best use. They do not easily accommodate very heavy or outsized cargo, which makes unit integrity more difficult to sustain. And their increasing average vessel size implies a greater consequence if a single vessel is lost.

Goal and Objectives:

The broad goal of this study is to support the optimal delivery of materiel during deployment and sustainment in a container-dominated environment. The target is achieving the best, not necessarily the maximum, use of containers.

Within this framework, the study has three primary objectives:

1. Provide documentation of DOD containerization programs and identify issues around the use of containers in wartime. This study is to serve as a reference for past and current efforts. Nineteen seventy (1970) was selected as the start year for the historical documentation because DOD focus on the post-Vietnam use of ISO containers began in earnest at approximately that time. An annotated bibliography related to containerization is included as part of the historic documentation.
2. Highlight unresolved issues around the use of containers in wartime. An overview approach was specified whereby general issues related to DOD's optimal use of a commercial delivery system, which is container-dominated, would be identified. The emphasis is on ISO containers used as the transportation "envelope," but work- and live-in containers (tactical shelters) are addressed, particularly as they relate to air movement requirements. This study indicates those areas where the integration of containers has not been achieved or where the impacts of containerization have not been fully evaluated.
3. Draft a framework for action to resolve open issues. Based upon analysis of the findings of (2), above, this study outlines future actions to assist in resolving the issues.

Approach:

The study team conducted a detailed assessment of containerization efforts, programs and capabilities in several areas. These areas included operating concepts, doctrine and policies, management, hardware issues, total system assessments, requirements estimates, specialized container programs, and commercial trends. The time frame for the assessment was 1970 through 1988. The study team used a combination of interviews and literature review to identify issues and determine the extent to which they have been resolved/considered by DOD elements. This included the review of several hundred reports and studies, and the conduct of interviews with representatives of numerous organizations in DOD, DOT and industry. After

integrating the findings of the research into a meaningful picture of unresolved issues, a recommended framework for action was developed. The framework includes near- and long-term actions with recommended responsibilities going beyond the J-4.

Management of Containerization in DOD:

The Joint Logistics Review Board report entitled, Logistics Support in the Vietnam Era, (especially Monograph 7- Containerization), was the primary document that supported and directed DOD's containerization efforts starting in 1971. The recommendations of this Board, also known as the Besson Board after its chairman, Army General Frank Besson, resulted in the establishment of the DOD Project Manager for developing a Container-Supported Distribution System. After 1975, the Project Manager was eliminated and was replaced by a more decentralized, lead-Service approach which prevails today.

Efforts to integrate containerization into DOD deployment, supply and transportation systems continue in 1988. While considerable advances have been made, implementation has not been complete. Within the decentralized approach, there are moves to greater coordination around containerization in several of the Services and there is a general sense in the community that USTRANSCOM will play an important and leading role once it is fully operational.

The basic DOD container policy (DOD Directive 4500.37) has been in effect since 1972. The primary aspects are: (1) DOD relies primarily upon commercially-provided container resources and services, (2) containers are the preferred mode to transport cargo, and (3) certain provisions are made for DOD ownership and long-term lease of containers when commercial assets are not available or when they do not meet military requirements.

Open Issues:

While providing an historical record of container efforts in DOD and documenting achievements in developing container delivery systems, this study also identifies unresolved/incomplete issues which should be addressed. This

section is a list of these issues, presented at a system level. Details for each Service and the Transportation Operating Agencies (TOAs) are provided in summary parts of each section of the main report.

1. Container Concepts/Policies

Services do not have comprehensive, written policies for container use based upon a system-wide concept of container distribution. This is not to say there are no Service container policies. Containerization concepts to support specific programs has been addressed in considerable detail, e.g., Army resupply, Marine Corps Field Logistics System, Navy Construction Battalions, Air Force Air Movement System. But some areas have received little attention, particularly policies regarding surface deployment of Army and Air Force unit equipment.

To the extent that explicit concepts and policies provide "roadmaps" for planning execution under various scenarios, the overall guidance to ensure that all subsystems will form a seamless distribution system is lacking. In effect, many distribution systems exist and may compete rather than interface with each other. Several of the issues listed below result from the gaps in concepts and policies to provide system-wide guidance.

No full systems analysis of the impact of container usage in wartime has been conducted. Therefore, identification of all critical constraints and identification of alternative solutions has not occurred.

2. Container Requirements

Wartime time-phased container movement requirements are not fully known and estimation procedures have not been fully developed. Therefore, the adequacy of commercial sector inventories cannot be determined. While the inventory of standard containers may be adequate, special containers which may be needed for unit equipment are not plentiful. Alternatives for eliminating shortfalls should be developed.

3. Container Acquisition

Although DOD relies on the commercial sector for provision of containers and peacetime Container Agreements with ocean carriers are likely to continue early in a deployment, an agreement to obtain containers directly from container lessors in an emergency is not in place. This could be especially critical for acquiring large numbers of commercial containers to augment the MILVAN fleet to carry ammunition aboard dedicated ships. Given neither a comprehensive requirement estimate nor an in-place method to acquire large numbers of containers, the container-oriented distribution system is on an unsure foundation. Additionally, allocation of containers if shortfalls exist requires a method for prioritizing allocation among competing uses.

4. Force Structure including Civilian and Host Nation Support

Planning the number and capabilities of support units should reflect the character and volume of the cargo throughput. Military, civilian and host nation support should be coordinated. With incomplete estimates of either container movement requirements or container handling capabilities, the ability to develop sufficient organic capability and assure at least a clear understanding of the ability to accomplish the cargo movements in required time-frames is unknown.

5. Facility Readiness

Undefined concept and policy areas cause inadequate nodal preparation for container throughput. Transportation system nodes which are expected to handle containers (e.g., CONUS installations, ammunition plants, and depots, theater distribution points, aerial and ocean ports) must have appropriate container handling equipment, materiel handling equipment and physical facilities.

6. Transition to Wartime Conditions

Peacetime distribution procedures will not continue in wartime. To mitigate transitional disruptions, regular incorporation of wartime procedures in

peacetime and/or exercises to practice wartime container distribution should occur.

7. Special Delivery Systems: Containerized Ammunition Distribution System (CADS), Logistics Over the Shore (LOTS) and the Air Movement System

CADS requires further attention. The organic fleet of CADS MILVANS is inadequate for wartime ammunition movements. The concept of augmenting the organic fleet by integrating commercial containers into CADS has not been achieved. The issue of ISO compatibility for the Palletized Loading System calls for high level review. Issues around container condition criteria which currently limit the number of containers available to carry ammunition should be resolved.

The LOTS subsystem is based upon a coherent concept and policy, and planning for expected container throughput has been conducted. Technical problems due to the operational environment have not been resolved and new doctrine has not been tested. Therefore, the over the shore discharge of containers has not yet been executed as planned.

The Air Movement System presents difficult intermodal challenges. The tracking of ISO tactical shelters and containers used as unit equipment should occur as these represent the minimum container airlift requirement for which MAC must prepare. There is no clear picture of container handling capability in the face of a rapidly growing requirement to deploy units by air with their organic containers and tactical shelters. Also, regular exercise of the system in peacetime has not occurred.

8. Integration of Container Policy and Deliberate Planning

The use of containers in the distribution system should be reflected in the deliberate planning process. Avoidance of shortfalls and excesses in OPLAN execution should be the goal. Therefore, realistic estimates of container use and its implications for movement scheduling by the TOAs must be reflected. Also, unambiguous identification of containerizable cargo should be included in TPFDDs to permit optimum ship utilization.

9. System Visibility and Flow Control

A system to manage container distribution under wartime conditions is required. From the perspective of the Defense Transportation System, a common user system for container visibility and flow control is preferred. Such a system would generate peacetime management benefits in addition to its wartime command and control features.

10. Intra- and Inter-Service Coordination

Management of the container-oriented logistics system requires attention provided through a single point at a level to afford visibility and coordination. Decentralization of oversight aggravates lack of system integration. Also, inter-Service coordination, particularly when one Service impacts the performance of another, is required. This is particularly important with the Army which represents a large portion of the movement requirement and, therefore, greatly impacts the surface and air transportation segments. Both intra- and inter-Service policy coordination and communication enhance the development of a coherent distribution system.

11. Coordination with the Commercial Sector

There is no established mechanism for on-going interaction between DOD and the commercial sector on container issues. Coordination and communication on fulfillment of DOD requirements is essential. DOD needs information exchange with the commercial sector on many issues including container inventories and availability, container and intermodal trends that impact the DOD distribution system, and advanced technologies in equipment and automated tracking.

Framework for Action:

A framework for addressing these issues, consisting of thirty-seven recommended actions organized by functional requirement, is presented. General sequencing of actions, recommended responsible DOD element(s) for each, and a four-level priority scheme are included. The emphasis as

reflected in the priority scheme stresses a centralized approach to key system-wide issues through high level management, coordination and visibility. The recommended actions include:

1. Develop comprehensive written Service container policies,
2. Estimate system-wide impacts of alternative Service container policies and develop a modeling capability for continuing policy evaluation,
3. Revise Service doctrine to reflect container policy,
4. Determine the number of standard and special containers required to implement container policies,
5. Estimate the requirements for a nucleus DOD-owned container fleet,
6. Determine the requirement for commercially-supplied containers,
7. Identify commercial sector container inventories,
8. Estimate expected container availability,
9. Determine expected container shortfalls,
10. Identify alternatives to alleviate container shortfalls,
11. Track commercial sector inventories,
12. Establish mechanisms for acquiring commercial containers in emergency situations,
13. Estimate the numbers, types and skills of military support units for container distribution for a set of scenarios,
14. Based upon scenario-specific container policies, estimate the requirement for, and the availability of, host nation and civil support for

container handling and throughput,

15. Estimate whether shortfalls in military, civil, and host nation support exist,

16. Identify and implement methods to eliminate container handling and movement shortfalls including increased use of the civil sector/host nation support and through additional military units, equipment, and training,

17. Assess the adequacy of transportation system nodes to handle wartime container throughput under various scenarios,

18. Develop and implement a plan to upgrade container handling capabilities at system nodes, as required,

19. Determine total system impacts of implementing wartime procedures in peacetime,

20. Implement and/or exercise wartime distribution procedures,

21. Establish ammunition containerization policies, including consideration of increased ISO compatibility of field systems such as PLS,

22. Integrate commercial containers into CADS,

23. Work with the Coast Guard and industry to determine if the condition standard for ammunition containers can be relaxed,

24. Determine the requirement for a nucleus, DOD-owned ammunition container fleet,

25. Establish a west coast ammunition container facility,

26. Conduct regular LOTS exercises to assess and improve the capability to transfer, marshal, retrograde and manage containers,

27. Determine the optimal level of containerization for airlift,
28. Track tactical shelters and containers used as unit equipment,
29. Validate the container airlift requirement based upon Service policies,
30. Assess and upgrade, as required, the capability to handle containers and shelters at APOEs and APODs,
31. Examine JOPS for consistency of cargo designation for containerization with container policies,
32. Examine and revise TOAs' models for consistency with container policies,
33. Develop an automated system for maintaining the visibility and management of the container distribution system,
34. Develop a system for tracking ownership and location of DOD-owned containers and tactical shelters,
35. Designate containerization points of contact for each Service and TOA,
36. Establish an action group to coordinate, integrate, enhance, and advocate container programs within DOD, and
37. Establish a government/industry containerization forum.

Organization of the Study:

Study results are presented in three volumes. Volume I documents past efforts, identifies issues around container use, and presents unresolved issues. Volume II presents the framework for addressing unresolved container issues. Volume III contains the annotated bibliography, which concentrates on studies and reports rather than articles in magazines and journals.

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1.0 INTRODUCTION

This report presents the findings of a study conducted by the Transportation Systems Center (TSC), Research and Special Programs Administration, U.S. Department of Transportation, on containerization in the Department of Defense wartime logistics system. TSC was tasked by the Strategic Mobility Division of the Organization of the Joint Chiefs of Staff (OJCS, J-4) to undertake the study. This introductory section explains the background and objectives of the study as well as the methodology used by the TSC study team. An overview of subsequent sections is also included.

1.1 Background

The use of containers for both peacetime and wartime movements of military supplies and equipment has received considerable attention since the Vietnam era. Two interconnected reasons explain this. First, containerization based on international standards has come to dominate international trade, particularly on developed trade routes. The commercial viability and hence the availability of militarily useful (non-container) ships has declined precipitously in the U.S. and allied merchant fleets. The makeup of the available fleets forces large-scale deployments to depend on non-self-sustaining containerships for a large proportion of the lift.

Second, dependence on containerization has been and continues to be a two-edged sword for DOD. There are substantial and generally well-recognized benefits to DOD as a shipper using containers. These benefits include lower cost, decreased shipping time and improved cargo protection/security. However, containerships are not ideal military assets. They require continued access to well developed ports and supporting infrastructure for their best use. They do not easily accommodate very heavy or outsized cargo, which makes unit integrity more difficult to sustain. And their increasing average vessel size implies greater loss to the war effort if a single vessel is sunk.

Implementing intermodalism in the airlift portion of the DOD distribution system has posed additional issues. The lack of a lightweight, intermodal air/land container, container incompatibility with the Air Force's 463L pallet

system, the lack of both sufficient peacetime airlift eligible cargo to test the system, and defined wartime requirements are among the primary issues hampering integration of containers into DOD's airlift system. In addition, the increasing inventories of tactical shelters, which are ISO containers with work- and live-in capabilities, present lift requirements for which DOD must be prepared.

The Joint Logistics Review Board report entitled, Logistics Support in the Vietnam Era, (especially Monograph 7- Containerization), was the primary document that supported and directed DOD's containerization efforts starting in 1971. The recommendations of this Board, also known as the Besson Board after its chairman, Army General Frank Besson, resulted in the establishment of the DOD Project Manager for developing a Container-Supported Distribution System. After 1975, the Project Manager was eliminated and was replaced by a more decentralized, lead-service approach which prevails today.

Efforts to integrate containerization into DOD deployment, supply and transportation systems continue in 1988. While considerable advances have been made, implementation has not been complete. In January 1987, the Conference of Logistics Directors addressed concern over lack of central management and oversight of containerization efforts throughout DOD. The concept for establishing a steering group was approved by the Service and Unified/Specified Command logistic directors at that conference. Subsequently, the Joint Containerization Steering Group was formed as a working group of the Joint Logistics Board under the auspices of the Organization of the Joint Chiefs of Staff (J-4). However, the Steering Group was abolished in 1988 and the decentralized approach continues to prevail. Within this approach, there are moves to greater coordination around containerization in several of the Services and there is a general sense in the community that USTRANSCOM will play an important and leading role once it is fully operational.

1.2 Objectives of the Study

The broad goal of this study is to support the optimal delivery of materiel during deployment and sustainment in a container-dominated environment. The

target is achieving the best use of containers, not necessarily their maximum use. Within this framework, the study has three primary objectives:

1. Provide documentation of DOD containerization programs. This study is to serve as a reference for past and current efforts. 1970 was selected as the start year for the historical documentation because DOD focus on the post-Vietnam use of ISO containers began in earnest at approximately that time. An annotated bibliography related to containerization is included as part of the historic documentation.
2. Highlight unresolved issues around the use of containers in wartime. An overview approach was specified whereby general issues related to DOD's optimal use of a commercial delivery system, which is container-dominated, would be identified. The emphasis is on ISO containers used as the transportation "envelope", but work- and live-in containers (tactical shelters) are addressed, particularly as they relate to air movement requirements. This study indicates those areas where the integration of containers has not been achieved or where the impacts of containerization have not been fully evaluated.
3. Draft a framework for action to resolve open issues. Based upon analysis of the findings of (2), above, this study outlines future actions to assist in resolving the issues.

The objectives have several implications. The study is an assessment of containerization in deployment and sustainment plus the development of a course of action to enhance wartime delivery of materiel in a container-dominated environment. It is not within the charter of the study to answer open questions of substance (such as developing a new estimate of container requirements or determining optimum levels of containerization for unit equipment).

1.3 Approach

The study was conducted in four phases. First, a preliminary analysis of documents and discussions with key players helped the study team articulate key containerization issues and refine the direction and emphasis of the second

phase. In the second phase, the study team conducted a more detailed assessment of containerization efforts, programs and capabilities in several areas. These areas included operating concepts, doctrine and policies, management, hardware issues, total system assessments, requirements estimates, specialized container programs, and commercial trends. This included the review of several hundred reports and studies, and the conduct of interviews with representatives of numerous organizations in DOD, DOT and industry. The third phase involved integrating and analyzing the findings of the second phase into a meaningful picture of unresolved issues. In the fourth phase, the program plan was developed. The plan includes near- and long-term elements with recommended responsibilities going beyond the J-4.

The study concentrated on containers and transportable shelters which meet the standards of the American National Standards Institute (ANSI) and the International Standards Organization (ISO). Non-ISO containers and shelters were not addressed.

No single OPLAN was used as a focal point. Generally, containerization issues were considered against the backdrop of a large-scale scenario.

The annotated bibliography was limited to citations which met one or more criteria. Namely, the work must (1) document key past or current containerization effort(s), (2) address specific containerization issues, (3) provide a methodology which can be applied to containerization issues, (4) provide general information on the DOD distribution/logistics system which the TSC study team deems appropriate for those interested in container distribution, and/or (5) define roles of DOD elements that have responsibilities in the area of containerization.

1.4 Organization of the Study

The results of this study are presented in three volumes: Volume I is a discussion of the issues and the history; Volume II presents the framework for action to address unresolved issues; Volume III is the annotated bibliography.

The remainder of Volume I is organized as follows:

- Section 2.0 - Description of a Container-Oriented Distribution System
- Section 3.0 - DOD Container System Management and Policy
- Section 4.0 - Army Containerization
- Section 5.0 - Navy Containerization
- Section 6.0 - Marine Corps Containerization
- Section 7.0 - Air Force Containerization
- Section 8.0 - Logistics Over the Shore
- Section 9.0 - The Transportation Operating Agencies and Containerization
- Section 10.0 - Deliberate Planning and Containerization
- Section 11.0 - Commercial Trends
- Section 12.0 - Summary Conclusions and Issues

- Appendix 1 - DOD Directive 4500.37, "Management of the DOD Intermodal Container System"
- Appendix 2 - DOD Inventory of ISO Containers and Tactical Shelters

Acronyms

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2.0 CHARACTERIZATION OF A ROBUST CONTAINER-ORIENTED LOGISTICS SYSTEM

The purpose of this section is to describe in general terms the characteristics of a container-oriented logistics system which would be effective and responsive in deploying and sustaining military forces. These characteristics provide the backdrop against which this study examines past and current containerization efforts and determines those aspects which have not been fully addressed and/or implemented to realize the full potential of, or mitigate the difficulties caused by, containerization.

One point of view in addressing containerization is cargo type: unit equipment (UE), general resupply and ammunition. Functional views of the distribution system are also important. Most of this section describes these functional views of a robust container-oriented distribution system, which are listed in Table 2.1.

Containerization initiatives, however, have focused on the movement of the three cargo types. This cargo categorization has prevailed in addressing containerization, and no rationale emerged during the course of this study to diverge from it. Problems vary greatly for containerizing unit equipment and for containerizing resupply. For unit equipment, the central challenge is moving many large wheeled and tracked vehicles, which do not fit in standard containers, in a fleet composed largely of containerships. Containerizing unit equipment also imposes requirements on the CONUS and theater distribution systems. The movement of resupply is less problematic relative to the use of containers and containerships because most supply classes are readily containerizable. Therefore, surface resupply issues focus less on the lift itself and on fitting materiel into containers, and more on planning for the impacts on the CONUS and theater distribution systems. (The nature of the lift itself is, however, important for container airlift movements). Peacetime movements of supplies are "business as usual" for DOD, whereas containerizing unit equipment is not routinely tested and is much less resolved for wartime.

Ammunition presents special handling and shipping concerns due to the characteristics of the commodity. DOD does move containerized munitions in

TABLE 2.1
FUNCTIONAL REQUIREMENTS FOR A ROBUST
CONTAINER-ORIENTED DISTRIBUTION SYSTEM

- o System Concepts and Policies
- o Container Doctrine
- o Container and Transportation Assets: Requirements and Acquisition
- o Facility and Cargo Readiness
- o Force Structure including Civilian and Host Nation Support
- o Transition to Wartime Conditions
- o Special Delivery Systems
- o Integration of Container Policy and the Deliberate Planning Process
- o System Visibility and Flow Control
- o System Flexibility
- o Intra- and Inter-Service Communication and Coordination
- o Commercial Trends and Technologies

MILVANS in peacetime, but some issues around the use of commercial containers are not resolved.

The functional characteristics of a container-oriented distribution system that is robust in wartime overlay issues surrounding container movements by cargo type. Therefore, this study first documents these cargo-related efforts and then presents a functional overview of distribution system issues. The functions are discussed in the following subsections; they describe an ideal or robust container-oriented distribution system.

2.1 System Concepts and Policies

An origin to user concept for container-oriented distribution provides the framework for planning, impact and constraint identification, and system implementation. Concepts and policies may vary greatly depending upon the deployment scenario. Size of deployment, intensity of conflict and operational environments are key variables.

Interconnectivity of distribution system segments requires that it be examined in its totality because decisions and actions for one segment impact other system segments. This is particularly critical in time-constrained movements. Stated policies provide additional guidance for the implementation of the system concept and for the development of requirements estimates. The concept and policies for the container system should address:

1. The goals of the system, e.g., to use containerization to deliver materiel in good condition where and when it is needed;
2. Objectives for reaching the goal, i.e., specified containerization levels at links and nodes of the system. This must be balanced against available handling, line haul and strategic lift capabilities.
3. Integration of containerization with supply and transportation systems. The transportation system must be capable of expediting the movement of containers, and the use of containers must mesh with various supply doctrines and systems.

4. Uses of types and sizes of containers;
5. Specialized subsystems required due to operational considerations or commodity characteristics;
6. Non-transportation uses of containers;
7. Use of host nation support and civilian organizations for container movement and handling,
8. Use of commercial versus organic containers;
9. Measures of effectiveness, e.g., productivity, cost, speed, equipment utilization;
10. Exceptions to the concept/policy, and
11. Responsible organizations for policy implementation.

2.2 Container Doctrine

Doctrine implements the system concept through stated procedures and methods for reaching desired goals. Doctrine addresses tasks and their sequence and indicates what will be accomplished, how much needs to be done, where and by whom. Considerations pertinent to the doctrine include personnel and equipment requirements (including capabilities and rate at which tasks can be accomplished), operating environment, commodity characteristics, carrier characteristics, geographic/site characteristics. The dissemination of information through, e.g., manuals and training, should reflect container policies.

2.3 Container and Transportation Assets: Requirements and Acquisition

Based upon the expected level of containerization developed in the concept and implemented through policy and doctrine, the development of time-phased

container movement requirements by type and location should be estimated. The requirement permits correct number and types of containers to be spotted at stuffing locations and provides information to ensure that container system functions can be executed. Arrangements for acquiring the containers should be made in peacetime to avoid delays in wartime.

Container movements impact the character of the transportation assets required for line-haul. In CONUS, MTMC must be able to acquire the appropriate transportation assets such as railroad cars and chasses, and in the theater, the force structure, and unit capabilities and transportation infrastructure should match the character of the throughput. Handling retrograde should also be considered.

2.4 Facility Readiness to Handle Containers

Outload, intermediate and receiving depots, installations, and bases should be designed to accommodate containers. Considerations include ramps, docks, marshalling and staging areas. Appropriate Container Handling Equipment (CHE) and Materiel Handling Equipment (MHE) must be available. Throughput capabilities should match movement requirements to avoid bottlenecks or underutilization of resources.

2.5 Cargo Readiness

The supplies and equipment to move in containers through the transportation system should be available and ready in the required time-frames. Equipment must be in transportation-ready condition at container stuffing points and requisitioned supply items should be available and ready.

2.6 Force Structure including Civilian and Host Nation Support

Plans for accomplishing container movements through a combination of military, civil and host nation support should be in place. Such plans encompass the use of civilian support at CONUS nodes, e.g., installations and ports, and the use of Host Nation Support Agreements for port and inland moves in the theater. Evaluation of Service capabilities against movement requirements indicates

the amount and nature of expected shortfalls to be supplied from other sources. Information on the types, number, location and capabilities of units is required.

2.7 Transition to Wartime Conditions

The extent to which the peacetime container distribution system operates in the same manner as wartime will be a factor in the ease of transition and the efficiency of system operation. Ideally, the wartime system is implemented and/or exercised in peacetime, with the primary difference being the amount of cargo moving through the pipeline. Implementing new procedures under emergency conditions increases the likelihood that the flow will not be smooth. The cost reduction incentive that influences peacetime procedures may, however, result in a system which must be changed to meet a wartime scenario when least time and operational imperatives dominate.

2.8 Special Delivery Systems

Special operational environments and cargo considerations necessitate additional concepts, policies and doctrine. For DOD, Logistics Over the Shore (LOTS), Containerized Ammunition Distribution (CADS) and Air Movement of Containers are three such special subsystems.

2.9 Integration of Container Policy and the Deliberate Planning Process

For a wartime container delivery system, OPLANS are developed in the deliberate planning process to describe implementation of concepts of operation for various scenarios of U.S. involvement in world and regional conflicts. They contain data on the time-phased movement of combat units, support units and supplies. Concepts of and policies for container use should be reflected in the plans, and the plan must be executable at all links and nodes. Estimates of OPLAN feasibility should reflect assumptions about the manner in which the parts of the system will work. The plan is flawed if it reflects utilization of a container-oriented distribution system which is not in place or whose functions cannot be executed. It is also flawed if efficiencies of containerization can be realized but are not reflected in the planning process.

The degree to which there is a mismatch between the plan and real operations will determine the extent to which shortfalls or underutilization of capabilities may occur in plan execution.

2.10 System Visibility and Flow Control

Extensive use of containers requires a system to manage both the van and its contents. Diversions and reprioritization and vessel stow plans for efficient off-load require in-transit visibility. Managing the van increases the likelihood of timely retrograde and recycling and avoidance of bottlenecks at nodes. This requires flexible, adaptable and reliable automated systems.

2.11 System Flexibility

The container distribution system should maintain the flexibility to respond to unexpected disruptions caused by wartime conditions. This flexibility includes the ability to implement alternative means and location of cargo movements and deliveries. Information on the vulnerability of the primary delivery plan is essential.

2.12 Intra- and Inter-Service Communication and Coordination

Development and implementation of a coherent logistics system requires coordination within each Service. In addition, communication and coordination between the Services enhances information flow that avoids duplication of efforts and permits resolution when policies and procedures of one Service impact another. This implies both specific issue-oriented coordination and broad, continuing high level communication to assess progress and priorities.

2.13 Commercial Trends and Technologies

The DOD relies upon the commercial transportation sector which is driven to increase competitiveness and profit, not wartime effectiveness. Therefore, DOD distribution concepts should reflect utilization of this system and be prepared to use emerging technologies to avoid duplicative development and to take advantage of new enhancements. However, not all developments in the civil

sector resulting from market pressures will benefit DOD. Therefore, DOD should be cognizant of and monitor trends that could negatively impact the execution of its concepts, and should work together to mitigate negative trends.

2.14 Summary

The preceding subsections on critical aspects of an effective container delivery system can be summarized as a simplified picture of a robust and dependable container-oriented distribution system:

1. The requirements for moving containers through the system should be known, including requirements for specialized containers,
2. The system's capabilities, a function of facilities, personnel and equipment, should be known for all links and nodes,
3. Discrepancies between requirements and capabilities should be highlighted and addressed,
4. The cargo should be ready to move within required time-frames,
5. The wartime distribution system should be the same as the peacetime system to ensure ease of transition and should be flexible to respond to disruptions,
6. Operations plans should be executable with no shortfalls and only minimal excess or unused capacity,
7. Automated systems should be in place to manage the flow of containers, and
8. Coordination and communication are necessary for the full integration of subsystems into a "seamless" distribution system.

3.0 DOD CONTAINER SYSTEM MANAGEMENT AND POLICY

This section outlines the management history of DOD's container-oriented distribution system. The intention is to provide some "lessons learned" and explain current management structures, responsibilities, initiatives and DOD container policy. Table 3.1 highlights the chronology of events addressed in the Section.

3.1 Project Management, 1970-1975

3.1.1 The Joint Logistics Review Board (JLRB) Findings

On February 17, 1969, the Deputy Secretary of Defense established the Joint Logistics Review Board (JLRB) to "review worldwide logistic support to U.S. combat forces during the Vietnam era so as to identify strengths and weaknesses and make appropriate recommendations for improvement." The JLRB was chaired by General Frank S. Besson, Jr., and is often referred to as the Besson Board.

In 1970, the JLRB issued its analysis of logistic operations in support of U.S. forces in Vietnam. The report entitled, Logistics Support in the Vietnam Era, consisted of three volumes and eighteen monographs. Monograph 7 of that report addressed containerization, and recommended the establishment of container-oriented logistic systems as the principal means of supporting military forces in the future. The JLRB concluded that such systems would result in significant improvements in logistic support at reduced costs, and recommended that the Army and Air Force lead separate but coordinated development efforts for surface and land-air-land container-supported distribution systems. To the JLRB, the issue was not whether DOD should adapt to the emergence of containerization, but how best to incorporate its advantages into logistics planning and execution. Table 3.2 lists a synopsis of containerization recommendations from the JLRB report.

TABLE 3.1: MANAGEMENT CHRONOLOGY

1970	Joint Logistics Review Board publishes its report, <u>Logistics Support in the Vietnam Era</u>
1971	Establishment of the DOD Project Manager for a Surface Container-Oriented Distribution System, the Land-Air-Land Task Group, and the Joint Container Steering Group (JCSG)
1972	DODI 4500.37 "Ownership and Use of Containers for Surface Transportation and Configuration of Shelters/Special Purpose Vans"
1973	DOD Master Plan for a Container-Oriented Distribution System
1975	Disestablishment of the DOD Project Manager Office Establishment of the Project Manager for Army Container-Oriented Distribution System (PM ACODS) and the Air Force Container System Development Group (AFCSDG) TOAs assigned planning and development responsibility for control systems, port planning and synthesis of requirements
1976	Reissue of DODI 4500.37
1979	JCSG renamed the Joint Intermodal Steering Group (JISG) Disestablishment of PM ACODS
1981	Reissue of DODI 4500.37 Military Traffic Management Command designated single manager of intermodal containers
1984	JISG disestablished. Defense Transportation Policy Council established
1987	DODD 4500.37 "Management of the DOD Intermodal Container System" Establishment of the OJCS JCSG Establishment of USTRANSCOM
1988	Establishment of the Army Container Steering Group Disestablishment of the OJCS JCSG

Table 3.2: JLRB CONTAINERIZATION RECOMMENDATIONS

1. (That) the Department of Defense adopt a policy that all ocean-going military cargo that will fit in a container will move in a container, with deviations to this policy treated as clear-cut exceptions.
2. (That) the military departments exploit the use of containers by maximizing their use for: (a) moving unit equipment during deployments, (b) prebinning stocks to facilitate in-theater logistic operations, (c) general cargo distribution, and (d) temporary storage.
3. (That) the military departments design portable facilities such as shelters, shops, housing, communication centers, computer centers, command centers, and other advanced base functional elements so that they can be moved as standard van-containers.
4. (That) the Joint Chiefs of Staff determine the number and types of container-capable ships that must be in the nucleus fleet to implement a containerization policy that will meet DOD requirements until commercial containership service can be made available.
5. (That) the Secretary of Defense have legislation include provision for ensuring the responsiveness of modern U.S. flag containerships to meet military requirements.
6. (That) the Services jointly develop and test the capabilities and procedures for the conduct of logistics over the shore container operations. The Services should establish their requirements for a family of containers, containerships, and container-handling equipment to support LOTS operations and should procure sufficient quantities of this equipment.
7. (That) the Secretary of Defense support the requirements of the Services to ensure the capability to support the port clearance and onward movement of containers in the area of operations.
8. (That) the Secretary of Defense support military ocean terminal modernization including ammunition terminals.
9. (That) the Logistic Systems Policy Committee task the Departments of the Army and the Air Force to lead jointly staffed efforts to coordinate the development of land-water-land and land-air-land container-oriented logistic systems, respectively. The thrust of these efforts should stress the "how" and not the "why" of containerization, and be directed toward early development of container-oriented logistic systems.

3.1.2 Establishment of the Project Manager for Developing the Surface Container System

On May 8, 1971, the Deputy Secretary of Defense implemented the JLRB recommendation that the Army and Air Force be assigned as the Executive Services for Joint efforts to develop standard container-oriented distribution systems in support of air, land and sea forces. Due to extensive developmental work required for container handling at undeveloped water terminal and forward area locations, the Army was directed to establish intensive management procedures for developing surface systems. An Army-led DOD Project Manager (PM) for Surface Container-Supported Distribution Systems Development was established. The PM office was expected to complete the development by July 1974, when it would be phased-out.

DOD's Logistics Systems Policy Committee (LSPC) was also involved with the container system development project. The LSPC performed the following functions: (1) provided policy guidance for the effort, (2) annually reviewed the PM's charter, (3) received progress reports from the PM at regular intervals, and (4) reported progress to the Deputy Secretary of Defense.

The PM had the responsibility to develop a total systems concept. Planning, direction, development, procurement, testing and transition to Service/agency management were included within the PM's purview. Specifically, the Project Manager was directed to:

- (1) Prepare, maintain and implement a Project Master Plan to accomplish objectives;

- (2) Make technical and management decisions;

- (3) Approve and supervise all contractual actions required to accomplish the program;

- (4) Acquire and review Service requirements for support by the Development Project;

(5) Include recommended R&D projects and materiel acquisition plans into the Five-Year Force Structure Program; and

(6) Maintain cognizance of both new and existing unilateral Service development actions.

Prior to the development of a Project Master Plan, work on developing a container capability began. For example, the PM had three major tasks for FY'72: (1) evaluation of offshore containership discharge, (2) Containerized Ammunition Distribution System (CADS) development (shipments to Germany and Asia and tests to eliminate port handling restrictions), and (3) the MILVAN Pilot Operation (Army-owned containers for general cargo shipments). Early Service efforts also began. The Marine Corps explored modularization of the 8'x8'x20' cross-section and the Air Force addressed its Bare Base Program. The Army began a study of the use of containers to support the Army in the field and the Army and Navy examined techniques for off-shore discharge. The containerization of unit equipment was also examined as was the use of flatracks as a means of transporting vehicles in containerships.

3.1.3 Establishment of the Land-Air-Land Task Group

Evaluation of the use of containers in the air mode also began. DOD established the Air Force-led Land-Air-Land (L-A-L) Container Task Group in May 1971 to develop the L-A-L Container Supported Distribution System. The task group consisted of transportation and supply representatives from each Service, DSA (now DLA) and MTMTS (now MTMC). Milestones were established for a long-range plan to accommodate containers in the military airlift system, which made extensive use of the 463L pallet system.

3.1.4 Establishment of the Joint Container Steering Group (JCSG)

On June 14, 1971, the Office of Assistant Secretary of Defense for Installation and Logistics (OASD - I&L) established the Joint Container Steering Group to monitor the two sub-system organizations, coordinate the efforts, minimize duplication and ensure adherence with LSPC policy guidance. The 1971-1974 schedule for the Joint Steering Group reflected the intention that the program

be completed by July 1974. An original schedule had extended until 1975, but had been compressed in 1971 at the request of OASD (I&L).

3.1.5 The 1973 Master Plan

A document entitled, Surface Container Supported Distribution System: Department of Defense Project Master Plan, was completed in January 1973. The Master Plan included a system concept and management overview as well as a detailed schedule for developing the Container Supported Distribution System. The Master Plan reflected an intensively managed effort to ensure full system development as quickly as possible.

The Program was divided into six subsystems:

1. Operating and Control Procedures
Packaging, container and container
contents tracking, containerized munitions
storage, pilot operations
2. Container Equipment
Requirements for and procurement of general and special purpose
containers
3. Handling Equipment
Cargo and container handling equipment, including that for LOTS
operations
4. Surface Movement
Particular attention to offshore discharge operations and
highway (chassis and tractor) requirements
5. Facilities
Requirements and plans for marshalling areas, container handling
ramps, platforms, cranes, berths, at depots, plants and ports

6. Force Structure and Training

Impacts of increased container usage.

Most milestones were scheduled for completion within three years. Exceptions were development of military (not commercially available) general purpose material handling equipment (MHE) and container handling equipment (CHE), and MHE for LOTS operations. These were scheduled for completion in 1980.

Responsibilities for efforts continued beyond July 1974 would be delegated to the appropriate Service(s).

OASD requested inclusion of explicit details for using commercial container service in an addendum to the Master Plan. The Master Plan had focused upon military-owned and controlled containers. OASD felt close coordination with both the Maritime Administration and appropriate civil agencies was required to ensure that container requirements would be met from outside DOD for a major contingency. Specifically, OASD commented:

- Procedures (including hardware and software, if necessary) must be developed to interface between commercial container system operators and the military supply and transportation systems. Adaptation of commercial procedures or pooling with commercial systems seemed appropriate.

- The Master Plan should cover basic planning for the use of commercial port facilities and indicate anticipated short falls.

- The Master Plan should specify if and how training with MILVANS was more desirable than general experience achieved with commercial containers or specialized training provided by service transportation schools. (Note: the Master Plan stressed training with MILVANS).

- The Master Plan should include a program outline to assure the acceptability, suitability and efficiency of commercial containers for moving ammunition. Commercial containers potentially applicable to other special DOD commodities should also be addressed.

3.1.6 Extension of the PM Charter

In July 1973, the Steering Group membership unanimously supported extending the PM's charter beyond its planned July 1, 1974, phase-out date. The JCSG considered three issues of critical concern, requiring continued intensive management and oversight by the Project Manager.

1. Offshore Discharge of Containership (OSDOC) Methods and Equipment

The Steering Group did not feel that the problem of handling containers in offshore discharge situations had been solved. A joint service working group under PM chairmanship had been formed to solve the OSDOC problem. In its 1973 Annual Report, the Steering Group stated that "despite unilateral efforts by the Services to resolve the problem of discharging non-self-sustaining containerships in undeveloped environments, progress during the past and previous years has been negligible. Numerous proposals on this matter have been advanced, but lacking positive definition of requirements, none have been adapted and pursued either by an individual Service or on a joint basis"

2. Containerized Ammunition Distribution System (CADS) Development

Issues around a containerized ammunition distribution system had not been resolved. Specifically, Coast Guard regulations in 1973 were oriented to stowage of breakbulk munitions with no provisions for containerized explosives. The PM had initiated several tests to promote updating regulations to include commercial containers.

3. Timing/Scheduling of Major System Events

The overall implementation of the Master Plan required the planning and coordination provided by the PM. The JCSG felt that momentum could be lost if responsibilities were split, thereby increasing the likelihood of redundancy, incompatibility and lack of standardization.

A JCSG memorandum to OASD (I&L) of September 17, 1973, requested the one-year extension of the DOD PM thru FY'75. In October, 1973, OASD gave a firm

termination date of June 30, 1975. OASD felt developing an Over-the-Shore Discharge Capability and adapting commercial containers to carry ammunition justified the continuation of the PM's intensive management. However, OASD felt that if the PM Office continued beyond 1975, the container project would no longer be regarded as an ad hoc development group. Instead, it would become the nucleus of an operating agency which duplicated functions of existing DOD elements.

While extending the PM charter for one year, OASD also outlined new responsibilities for MTMC and MSC. In 1973, an estimated 70 percent of DOD's surface dry cargo (excluding ammunition) was containerized through a distribution system operated by the TOAs, which would serve as the basis for a wartime container distribution. But container system planning (through the PM) and container system operations (by the TOAs) had remained separate. OSD felt that containerization should be incorporated into contingency planning and that the development of transitional and wartime system and procedures was essential. Therefore, OASD shifted to MSC and MTMC planning and development responsibility for (1) container, cargo, and shipment control systems and procedures; (2) port facility assessment and planning, and; (3) synthesis of service requirement estimates. Thus, operation of the system became the responsibility of the TOAs, with the Army and the Navy retaining responsibility for hardware development.

3.2 Project Management, 1975-1979

Prior to the disestablishment of the Project Manager's Office, opinions differed relative to the merits of either returning all project management to the Services or strengthening and continuing the Project Manager role. The JCSG was the proponent of the decentralized management approach. As originally planned, the Services would be responsible for specific containerization efforts and the Air Force would retain responsibility for developing the land-air-land system.

The JCSG also proposed changes to the container system development organization. These proposals included: (1) that the JCSG continue, but not under the direction of the Logistic System Policy Committee, (2) that the OASD

representative become the permanent chairman of the JCSG, and (3) that a standardization group be formed, which reported to the JCSG.

The LSPC staff's alternative recommendation to that of the JCSG stressed the need for an even more centralized systems approach. The staff felt that increased visibility, efficiency and labor utilization were required. It proposed rechartering the Program Manager Office by combining both the surface and air system efforts into one project. The LSPC would resume responsibility for providing policy guidance to ensure integration of the many "container systems," which were developing, into one "container-oriented logistics system." The LSPC saw no need for the JCSG once the two efforts were combined and proposed that it be disestablished. The combined container development effort would be rechartered for five years.

Although there was Service support for the LSPC proposal, especially by the Air Force, the JCSG organization was adopted and implemented through the 1976 DOD Instruction (DODI) 4500.41 "Transportation Container Adaptation and System Development Management." The Container System Standardization/Coordinating Group (CSS/CG) was established to support the more active JCSG. The Group consisted of an officer from each Service and a civilian administrator from the Army.

In June 1975, the Air Force announced the formation of the Air Force Container System Development Group (AFCSDG) to work on Air Force container efforts. Also, the Land-Air-Land Task Group was rechartered to address container issues of all Services for the air mode, and the Army announced the establishment of a Project Manager for an Army Container-Oriented Distribution System (ACODS) at DARCOM (now AMC).

In 1977, the General Accounting Office (GAO) prepared a report entitled, Container-Oriented Logistics System - Will It be Ready When Needed by the DOD? The report concluded that under the lead Service approach, the JCSG had difficulty making policy decisions, resolving inter-service disputes and monitoring and coordinating the development efforts. The General Accounting Office (GAO) recommended that the Steering Group provide timely guidance on

policy and development matters, that it develop a comprehensive development plan, and that it establish mechanisms for taking corrective action.

In response, action was taken to rewrite the Project Master Plan and to establish it as an authoritative document providing development control. In addition, OASD planned to reissue DODI 4500.41 to more clearly define the functions and responsibilities of the JCSG.

In 1978 the GAO conducted another study related to DOD containerization efforts. The GAO report entitled, Progress Made and Improvements Needed in Developing a Containerized Ammunition System, concluded that basic questions about containerizing ammunition during a mobilization needed to be resolved, and that system requirements and capabilities had to be defined. Also, coordination was required between the Army and the Navy, and a CADS Plan needed to be developed.

3.3 Project Management, 1979-Present

In 1979, the JCSG was renamed the Joint Intermodal Steering Group (JISG) to reflect the connection between intermodalism and containerization. The CSS/CG was renamed the Intermodal Coordinating Group (ICG). Also, the Army's Project Manager for a Container-Oriented Distribution System was abolished in 1979 with residual functions assigned to the Container System Development Office of the Directorate of Materiel Management at DARCOM. The Container System Development Office was disestablished in 1981 with responsibility for its publication, The Container System Hardware Status Report, transferred to the Army Mobility Equipment Research and Development Command (MERADCOM). At the request of the JISG, the status of hardware items for the Navy and the Air Force were included in the publication beginning in 1979. According to the Status Report of 1982, MERADCOM became, at that date, the focal point for the development of the Army's Container Oriented Distribution System due to its responsibility for developing materiel handling, marine and rail hardware and containers.

By June 1980, the principals of the JISG discussed alternative approaches to meeting intermodal objectives and even questioned the need for and role of the JISG. OASD (MRA&L) decided to use the JISG as a forum for discussing

intermodal issues of the Services, but decided that the Services should receive tasking through Service secretariats to resolve issues. The ICG would be dissolved, but a Point of Contact would be appointed from each Service. In 1981 DODI 4540.6 "Intermodal System Development" was promulgated. JISG assumed an advisory role, with chain of command residing within the Services and DOD components. The JISG was to review the status of each program at least annually. The Master Plan was updated several times with program emphasis on CADS, LOTS, Air Movement, and SEASHEDS (enhancements to containerhips to give them a breakbulk capability for large equipment).

In a memorandum by the Deputy Secretary of Defense in 1981, sealift cargo and passenger booking was transferred from MSC to MTMC. This action consolidated under MTMC, as single manager, operational management in peace and war for intermodal containers and other cargo movements.

DODI 4540.6 was cancelled in 1984, and the Defense Transportation Policy Council (DTPC) was established (DODI 4500.45) to replace the JISG. Thus, DOD management of container system development became almost totally the responsibility of DOD components. The DTPC was organized to review and assess all DOD transportation and traffic management policies, programs and systems, and determine their adequacy for meeting peacetime and wartime requirements. The DTPC also reviews and evaluates the development, use and management of intermodal systems. While containerization is not explicitly mentioned in DODI 4500.45, the major container programs are briefed to the DTPC, usually on an annual basis.

In 1987, a new Joint Container Steering Group, a working group of the Joint Logistics Board, was formed. The group, chaired by the Chief of the Strategic Mobility Division (OJCS, J-4), was comprised of representatives of the Services, the major commands, the TOAs, DLA, OASD and elements of the Department of Transportation. In 1988, the JCSG was formally disestablished with future joint efforts expected to focus on ad hoc problem solving and issue coordination. The functions of the group were:

- To recommend future development of capabilities that optimize the planning for and use of containerization and intermodalism in a wartime strategic mobility role,

- To foster a coordinated, joint approach in the development of Service container/intermodal systems.

- To review progress and guide the development of containerization initiatives, including those directed by the Council of Logistic Directors,

- To serve as a clearinghouse for sharing information and data concerning containerization initiatives being worked by the Services, unified and specified commands, and

- To present to the Joint Logistics Board and the Council of Logistics Directors containerization issues, proposals and projects for consideration and adoption by appropriate Services and agencies.

In 1987, the United States Transportation Command (USTRANSCOM) was established. The three TOAs--MAC, MTMC and MSC--are included under this Command, although the TOAs remain major Commands of their parent Services. While initial focus has been on automated deployment and planning systems, USTRANSCOM's Concept of Operations also specifies responsibilities for optimizing DOD's intermodal capability through the integration of common user (air, sea, land and container) transportation systems and resources. Therefore, USTRANSCOM is expected to emerge as a focal point for container issues.

The Army, through the Strategic Mobility Division of the Office of the Deputy Chief of Staff for Logistics (DA DCSLOG, DALO-TSM) formed a Containerization Steering Group in 1988. The goal is to address Army-specific issues and develop a container policy.

3.4 Evolution of DOD Policy on Container Use

Department of Defense Instruction 4500.37, the primary policy document on container and tactical shelter use, underwent several revisions during the

1972-1987 period. The Instruction was issued in 1972, 1976, 1981 and 1987 (Note: It became a DOD Directive in 1987). Common to all versions of the policy are that: (1) DOD relies primarily upon commercially-provided container resources and services, (2) containers are the preferred mode to transport cargo, and (3) certain provisions are made for DOD ownership and long-term lease of containers when commercial assets are not available or when they do not meet military requirements.

The 1972 Instruction also addressed the need to develop a container-oriented distribution system as a matter of priority. In the 1976 version, a policy statement on the containerization of munitions was added. The development of the CADS was of high priority at that time, but the need for retaining a break-bulk capability for low-volume peacetime movements and for system flexibility was stated. Containerization was, however, considered the optimal method due to safety advantages. Twenty-foot containers were specified as the optimal size.

Four major changes occurred with the current 1987 version. First, OASD no longer approves the acquisition and long-term lease of containers. Heads of DOD components are authorized to approve, with information provided to OASD on procurements and leases of greater than 100 units. Second, responsibilities are enumerated for the Service Secretaries. Specifically, the Secretary of the Army, through the Military Traffic Management Command, is designated to manage and monitor intermodal surface containers in common-user service while in the Defense Transportation System. The Secretary of the Navy, through the Military Sealift Command, is designated as the DOD agent for procuring common-user intermodal containers to support DOD component requirements and capability assessments coordinated through MTMC. Additionally, the Secretary of the Air Force, through the Military Airlift Command is designated similar functions as MSC for the procurement of intermodal air containers and for implementing a container and shelter airlift system. Third, OJCS (J-4) is to provide oversight of Service container programs. Service plans that require assistance of or impact programs of other Services are to be brought to the OJCS for coordination. Last, container programs previously "packaged" as the Master Plan are listed by responsible organization, with annual updates presented to the DTPC. These programs include the Air Movement Plan (Air Force), CADS

(Army/AMC), the SEASHED program (Navy), OSDOC/LOTS (Army/Navy), Container Systems Hardware Status Report (Army/AMC) and the Container Requirements and Availability Study (Army/MTMC).

3.5 Summary Observations

The following are concluding observations about DOD management of container system development.

1. The basic DOD container policy has been in effect since 1972. The primary aspects are: (1) DOD relies primarily upon commercially-provided container resources and services, (2) containers are the preferred mode to transport cargo, and (3) certain provisions are made for DOD ownership and long-term lease of containers when commercial assets are not available or when they did not meet military requirements.
2. From 1971 to 1975, the management of developing a container-oriented distribution was centralized through the Army-led surface Project Manager Office and the Air Force-led Land-Air-Land Task Group. The original three-year time-frame seems, in hindsight, exceedingly aggressive and ambitious given the range of the projects. The time constraint on the duration of the charter required that all efforts be undertaken simultaneously. Therefore, it is not surprising that a "seamless" container distribution system did not result but, rather, compartmentalized container efforts evolved.
3. Development of container-oriented system concepts was, from the beginning, the responsibility of the Services. Therefore, a detailed, system-wide concept was not developed.
4. In 1975 OASD assigned more responsibility for containerization to the TOAs. Centralized system development management functions, however, were not assigned. Therefore, the operational versus planning dichotomy which OASD recognized and sought to eliminate was not resolved as it might have been if the TOAs had been delegated oversight responsibilities.

5. Management of the development effort was decentralized under the lead Service approach from 1975-1979, with OASD providing coordination as chair of the JCSG. The role of OASD became progressively advisory, with Services operating more and more autonomously. Currently, the DTPC requires annual updates on container programs from designated lead Services, as defined in the 1987 version of DODD 4500.47.

6. While concern has emerged over lack of central coordination of continuing containerization efforts, successful central management requires consensus among participants over goals, objectives, priorities and methods. Given Service-specific operational needs, the rationale for a decentralized approach after the initial efforts is defensible, but it required two elements for full success. First, success of a decentralized approach assumed Service maintenance of centralized oversight over their container-related programs, and this has not been fully effective. Second, wartime operational integration of Service intermodal programs had to be assured; this has been partially achieved.

7. Formation of the JCSG in 1987 and the Army Container Steering Group in 1988 reflect renewed activity around container issues and provide the opportunity to improve coordination within the DOD community and with industry. While termination of the JCSG in 1988 makes this more difficult, other ad hoc alternatives are worth pursuing until USTRANSCOM has developed sufficiently to assume the primary coordinating role.

4.0 ARMY CONTAINERIZATION

This section addresses Army efforts at developing a container-oriented distribution system. The subsections describe past and current efforts relative to containerizing unit equipment, general resupply and ammunition. While the primary focus uses the cargo classifications, system issues are also presented. The major subsections include:

- 4.1 Containerization of Unit Equipment - Surface Movements
- 4.2 Containerization of Resupply - Surface Movements
- 4.3 Containerization of Ammunition
- 4.4 Air Movements of Containerized Resupply and Unit Equipment
- 4.5 Container System Evaluations
- 4.6 Summary Observations/Issues

4.1 Containerization of Unit Equipment - Surface Movements

For a major deployment, the Army represents the largest portion of the unit equipment (UE) surface lift requirement. Therefore, the extent of its container use is particularly critical to realizing operational efficiencies and optimally utilizing lift assets to meet required closure times. However, given the characteristics of available ocean shipping and lack of clear Army policy and current experience, it appears that increased containerization of Army UE will have a great impact on the distribution system. Increased use of containers for unit equipment, moreover, also may reduce the efficiency of the lift (requiring more ship sailings) and preclude unit integrity aboard the same ship (because some items still may have to move on a breakbulk vessel). Enhancements for the containerships, e.g., SEASHEDs which are installed in ships to create a breakbulk capacity, may also be required.

4.1.1 Early Efforts at Containerizing Unit Equipment

The DOD Project Manager for a Surface Container-Oriented Distribution System left responsibility with the Services for developing mission-specific concepts for containerization. Ideally, the concept for containerization of unit equipment would match equipment and containers types. The extent of container

use, container stuffing locations, personnel requirements for stuffing/unstuffing in CONUS and in the theater, and requirements for specialized vans not available from the commercial sector would also be identified. Impacts such as cost, time, unit integrity, force structure, equipment and facility requirements, would have to be evaluated. With the dominance of commercial containerization and the trend toward larger containerships, policies on levels and decision criteria on levels of containerization have to be evaluated particularly closely.

Three early efforts to reconcile surface strategic lift characteristics and Army unit equipment deployment requirements were conducted by MTMC's Transportation Engineering Agency (TEA) prior to the development of the Project Master Plan. All three aimed at maximizing containerization of Army UE to optimize fleet utilization. Feasibility of moving by container or containership was defined as whether the equipment would fit anywhere on the containership (in a container or not). The three efforts were conceptual in that equipment was sized to containers, container cells and other spaces on the ship, but no container stuffing or cargo movement actually occurred.

In 1970, the Department of the Army requested that MTMC undertake the first of the three studies, a conceptual analysis of the use of containerships for unit deployments. The results were published in a four-volume report entitled, Unit Deployment by Container/Containership (UDC). The analysis simulated the loading of deploying units by first loading organic cargo-carrying vehicles with unit equipment and containerizing the remaining items in commercially available containers. FORSCOM's COMPASS equipment file was used for dimensional and weight data. Cross-checking unit equipment and container dimensions tested existing containers for both suitability to carry equipment and container utilization efficiency. Commercially available standard dry cargo containers and special purpose open-top and platform containers of different heights and lengths were evaluated. False decking in containership cells and deck loading of items too large to permit below-deck loading were used to accommodate non-containerizable items. The analysis considered combat, combat support and combat service support units.

The study concluded that containerizing unit equipment was feasible, but results also showed that much of the equipment could not be accommodated in commercial containers, and that deck loading significantly reduced ship cargo carrying capacity, thereby increasing the lift requirement. Considerations of off-load capabilities, feasibility of false-decking ships, development of securing methods and ocean terminal capabilities to support a containership unit deployment were beyond the scope of the study, but were recommended as further analyses. The study also recommended that a determination of the requirement for a vehicle container be conducted, and that the commercial sector be encouraged to increase its inventory of such equipment.

The second MTMC/TEA study in 1971, Unit Deployment by Containership - A Comparative Analysis of Concepts further examined the utilization of containerships for unit deployments. The study addressed methods for using oversize containers, platform containers and specially designed containership cell platforms to increase containership utilization, the major problem identified in the 1970 UDC study. The use of hypothetical-size containers i.e., not available from the commercial fleet (9'x8.5'x35' and 9'x10'x35') was analyzed. The analysis considered several load plans for transporting equipment falling into three categories--containerizable in standard containers, containerizable only in oversize containers, and non-containerizable in any practical-size container. The plans included all three categories of equipment for an infantry division consisting of nearly 120,000 measurement tons (MTONs), of which 36 percent was containerizable in standard containers. The number of ships required for the deployment using the plans was simulated. The best ship utilization resulted from using 8'x8.5'x35' dry cargo containers and 8'x35' flatracks in holds with varying tween deck clearances.

The third study by MTMC/TEA was conducted in 1971. The report entitled, Utilization of Flatracks in Force Deployment, examines the use of 8'x8.5'x35' flatracks and dry containers to move unit equipment and fifteen days of supply for five division force equivalents from CONUS to Europe. A closure time was designated for the move. This was not included in the earlier efforts and represented a further analytic step by examining efficiencies of the emerging maritime container industry. A fleet composed of containerships, Sea Barges,

Lighter Aboard Ships (LASH) and Roll-on/Roll-off vessels (Ro-Ros) was used for the simulation. Ports of embarkation (POEs) and ports of debarkation (PODs) were assumed to have all necessary handling and loading equipment.

The study determined the impacts of using flatracks for 2.5- and five-ton trucks rather than using only standard containers for containerizable equipment. Using flatracks, the average ship tonnage increased, and the required number of sailings and ships decreased due to better ship utilization and faster turnaround time. A 90-day closure time requirement for the five-division force was met in the simulation.

A summary of the early MTMC/TEA efforts at addressing containerization of Army unit equipment shows attention to an increasing number of variables that affect unit lift. Namely, the first study sized equipment to container assets and drew general conclusions about ship utilization, the second study focused on alternative stow methods and container sizes to improve utilization, and the third added a time dimension, supply movement requirements (in addition to UE), and a fleet composed of various ship-types. All three MTMC/TEA studies recognized that the efforts focused only on the ships and the fleet, with no constraints imposed by port handling capabilities or on the availability of containers.

The TSC study team identified no studies on the containerization of Army unit equipment between 1971 and 1978, although MTMC/TEA published Pamphlet 55-1 entitled, Transportability Data for TOE Vehicles and/or Outsize Equipment Eligible and Non-eligible for Loading in Cargo Containers, LASH Lighters, and Seabee Barges and on Flatracks, which provided guidance on unit equipment containerization. In 1975, MTMC revised PAM 55-2, Management and Stuffing of Containers, to provide information for container managers as well as for those engaged in the actual stuffing of the container. MTMC and the Military Sealift Command (MSC) also published a joint pamphlet (MSC P-4600 and MTMC Pam 55-13), DOD Container Delivery System in 1978 which described the peacetime container system used by DOD. (The current edition is MTMC Pam 55-13 issued in 1983).

In 1975, the Army Mobility Equipment Research and Development Command began a flatrack program for the Army by procuring three commercial and three

military prototype flatracks for test and evaluation. The commercial 40-foot flatracks had collapsible end walls; the military 40-foot flatracks had a somewhat higher tare weight with an equivalent gross weight rating, and end walls that folded outward to form a vehicle drive-on-rack. By 1979 the six prototypes had been tested, but the military flatrack program was cancelled in 1980, followed by cancellation of the commercial program in 1981. The Department of the Army had decided that sufficient numbers were available from the commercial sector, thereby precluding the necessity of an Army procurement program.

Beginning in 1977, the Joint Chiefs of Staff published three studies that reviewed and analyzed strategic mobility requirements and deployment alternatives for wartime scenarios. The studies were the Strategic Mobility Requirements and Program (SMRP) series, keyed to expected strategic lift assets in 1982, 1983 and 1984. Because containerization of Army UE was considered in special analyses in the 1983 and 1984 efforts, these mobility studies are included in this section.

SMRP-82 addressed a conventional conflict in Europe, and analyzed movement requirements for unit equipment, resupply and ammunition. While only general containerization conclusions were drawn that related primarily to ammunition, the second study in the series, SMRP-83, completed in 1978, reported an analysis of containerizing Army unit equipment and ammunition. The goal of the evaluation was to determine actions and programs that would improve the utility of containerships by determining the optimum mix of containerized unit equipment and ammunition to guarantee the earliest delivery of the force at the least cost.

At the time of the study, a major constraint for containerized ammunition movement was ocean terminal outload capacity which was limited to 500 containers per day at the Military Ocean Terminal at Sunny Point, NC (MOTSU). In addition, unit integrity issues of partially moving a unit by containership were recognized but not resolved. This situation could require planning for marry-up in theater if more than one ship was used, and would have to be evaluated against any closure time benefits gained by using containerships.

In the SMRP-83 study, containerization of unit equipment was incrementally increased under these four scenarios of container use: no containers, standard 40-foot containers only, standard containers plus 20-foot flatracks, and standard containers plus 20- and 40-foot flatracks. The delivery of deployment tonnage within time increments for combat, combat support and combat service support units was analyzed. Combinations of ammunition containerization alternatives (500 and 1,000 container throughput per day) with the unit equipment alternatives were considered.

The study noted that benefits of containerization for unit equipment were most pronounced during certain time windows, indicating that container use might have to vary through the deployment period. Other conclusions indicated that (1) programs for supporting increased ammunition containerization should be supported, (2) the Army should consider using commercially available flatracks for containerizing combat service support unit equipment, and (3) improvement in closure time due to the use of 20- and 40-foot flatracks did not appear to justify a DOD flatrack acquisition program.

SMRP-84, completed in 1981, also contains an analysis of the impacts of increasing levels of containerization for Army unit equipment, ammunition and resupply. This study addressed deliveries for a Persian Gulf scenario while SMRP-83 addressed a European scenario. Unit equipment containerization ranged from zero to 25 percent, ammunition from 25 to 70 percent and resupply was held constant at 90 percent. Four cases were evaluated against a fleet that consisted of breakbulk, container, Ro-Ro, LASH and barge ships. Programmed ammunition port workload capacity was also examined to determine if increased containerization exceeded the capacity.

This study, as SMRP-83, determined the levels at which containerization contributed to enhanced delivery and levels at which improvements were marginal. Resupply was added for consideration in this study, and trade-offs among the three were analyzed. For example, the payload efficiency of containerships decreased when Army UE was containerized resulting in delivery lags for ammunition and resupply (compared to the scenario when no UE was containerized). Additionally, SMRP-84 indicated that details on origins of

containerized movements of resupply and ammunition were necessary, particularly so that CONUS outload capabilities could be evaluated.

In 1988, the SMRP studies may be more important for their methodology in analyzing containerization of Army unit equipment than for their conclusions (although two container-related recommendations were implemented: MOTSU's outload capacity was increased to 1,000 containers per day and the Army flatrack programs were cancelled by 1980). A precursor to the current MIDAS (Multi-optioned Interactive Display and Analytic System) model was used and indicates the type of analysis and number of variables that could be considered. Also, while not included in the special containerization analysis, the SMRP studies examined depots for container outload capability and the cargo movement constraints that affected delivery to the ports. Therefore, the studies represent important steps toward considering the system-wide impacts of containerization.

The Congressionally Mandated Mobility Study (CMMS), completed in 1981, also included some conclusions pertinent to containerization. In scenario simulations, containerships for deploying forces went unused because unit equipment could not be readily accommodated. Therefore, the study concluded that systems that improved containership utilization merited attention. The CMMS also indicated the need to improve container off-load capability in austere environments and that LOTS programs should receive heightened visibility.

4.1.2 Recent and In-progress Efforts

A number of recent and in-progress efforts address containerization of unit equipment and the optimal use of the fleet. At the request of MTMC's western area command, American President Lines, Ltd., (APL) examined the potential of transporting the Army's First Infantry Division from Fort Riley, Kansas, to Asia using APL's CONUS rail and surface fleet capabilities. While the 1986 APL report was not available for this study, a synopsis was provided.

Movement of the unit equipment on containerships was of particular interest. APL estimated that approximately 1,700 forty-foot equivalent container units

would be required and that over 50 percent of the unit equipment would require flatracks. All containers except the flatracks would be source stuffed and moved via stack or liner trains to the port. Approximately five unit trains of 100 cars each would be required, and two APL containerships would accomplish the ocean move.

While the move could be accomplished using APL's assets, the Army's ability to meet its responsibilities was not addressed. Namely, deploying units would have to marshall and stuff containers at installations. Also, APL indicated that it could not meet the flatrack requirement from its own fleet, and that these assets would have to be acquired elsewhere. This indicates the need for the Army to determine its container requirement, its facility and personnel capabilities, and to arrange for obtaining large numbers of different type containers at appropriate locations within specified time-frames if an OPLAN is executed. To date, there is no indication to what extent the Army's responsibilities could be met within required time-frames.

In 1987, the GAO issued a report entitled, Army Deployment - Better Transportation Planning is Needed. The study examined unit readiness and unit outload plans to determine whether OPLANs could be executed within required time-frames. Generally, the GAO concluded that the Army has not identified requirements for and availability of commercial transportation services and that planned outload capabilities did not match those required for outload execution. While containerization was not specifically addressed, requirements for containerized movements adds another dimension to required information for CONUS outload. MTMC/TEA is currently developing an automated installation outload report, required by bases, installations and depots by AR 55-4 (DD Form 1726), which will result in better data on container handling capacities.

In June 1988, MTMC/TEA assessed the utility of double-stack railcars for military movements. The results, published in, Military Applications for Double-stacking Railcars, examined the extent to which UE for seven Army division types could be accommodated in containers or on flatracks suitable for movement by double-stack trains. The Double Stack Compatibility Model was developed to merge data on TRADOC's TOE allocations with FORSCOM's Equipment

Characteristics File (COMPASS) and dimensional and weight constraints of railcars, containers and flatracks.

The study found that large quantities of Army UE could be transported on these railcars and that 20- and 40-foot flatracks were the most useful. The Light Infantry Division was best suited for a double-stack movement and heavy divisions were the least suited. The study recommends that installations prepare to outload using double-stack trains. General impacts of double-stack railcars on the Defense Transportation System are addressed.

MTMC/TEA recently completed an analysis of the effect of various levels of container use for unit equipment, by unit type, on closure times. The study was conducted at the request of OJCS, J-4. Scenarios of container use were examined, including the use of 20- and 40-foot containers as well as flatracks and SEASHEDs. MTMC/TEA's TARGET model was used to determine containerizable equipment based on FORSCOM's equipment characteristics file (COMPASS). The Rapid Inter-theater Deployment Simulation Model (RAPIDSIM) was used to simulate movement requirements and closure times. The optimum mix of ships for deployment under each containerization scenario was also identified.

The results of the study show moderate improvement in unit closure with maximum containerization and significant improvement with the use of flatracks and SEASHEDs. Several issues pertaining to implementing a containerized UE deployment were raised including the ability to obtain and stuff containers and flatracks at home stations and the requirement to reconfigure containerships for flatracks and SEASHEDs. The study is expected to provide a foundation for concept development around containerization of UE.

4.1.3 Observations on UE Containerization for Surface Moves

Most interest in the containerization of Army unit equipment has focused upon the best use of the surface strategic lift assets, which are largely containerships. To carry this materiel on containerships requires stuffing eligible equipment in standard containers and/or using specialized equipment and enhancements, e.g., flatracks and SEASHEDs, that convert container cells to breakbulk use. This may, however, impact theater force structure or host

nation support requirements (including equipment requirements) if the throughput requirement for containers exceeds planned in-theater unit capabilities. CONUS movements are also impacted because a decision to containerize requires that outload functions include container loading that impacts personnel capabilities, equipment and physical aspects of the installations. The nature of CONUS line-haul may also be affected. There appears to be substantial modeling capability to analyze unit equipment containerization, particularly in relation to the surface fleet. Identifying constraint points, performing system-wide trade-off analyses and prioritizing competing requirements all need to be addressed.

Currently, Army containerization policy does not address the extent to which unit equipment should be containerized. Army doctrine for strategic deployment by surface transportation (FC 55-65) addresses the use of containers only generally. FORSCOM regulation 55-1 (Unit Movement Planning) discusses the use of CONEXs, not ISO containers. While the DOD policy (DODD 4500.37) indicates that maximum containerization using commercial assets is preferred, the containerization of UE has not been fully evaluated and system impacts have not been determined. Army Regulation 56-1, which implements the DODD, is being revised, and will define use more explicitly. The policy may have to evolve iteratively, however, as system impacts are identified and trade-offs evaluated.

4.2 Containerization of Resupply - Surface Movements

As early as 1968, the Army was examining the use of containers for resupply movements. A study by the American Power Jet Company entitled, U.S. Army Cargo Container Requirements, estimated container inventory requirements and cost savings (including time) for two routes--CONUS to Europe and CONUS to Vietnam. A comparative analysis of container versus breakbulk shipping was included, as was a discussion of using Army-owned versus commercial containers. Ammunition and refrigerated cargo were excluded from the study. The study recommended that the Army procure 20-foot containers and that it proceed with a pilot project to test container operations and requirements for handling and transportation equipment to confirm the advantages of containerization.

In 1970, the Army procured 4,500 ammunition restraint 8'x8'x20' containers and 2,200 general cargo containers of the same size. A MILVAN Pilot project was begun to test the shipment of both general cargo and ammunition. In 1973 and 1974, a refrigerated MILVAN was designed and tested, with a contract for 665 such vans awarded in 1976.

The Army's Training and Doctrine Command (TRADOC) addressed the use of containers for shipments of supplies to support the Army in the field. The lack of concepts, doctrine and equipment was felt to limit the integration of containers into the logistic system. The results, published in The Army in the Field Container System Study (1974), developed a system for delivering containerized materiel to the lowest practical echelon. This effort is the cornerstone of the Army's container resupply doctrine in effect today.

The objectives of the study were to:

1. Analyze and document current and proposed uses of containers to identify alternative container system concepts for the 1972-1982 time-frame;
2. Develop concepts, doctrine and procedures for the use of containers;
3. Identify problem areas in supply, transportation, maintenance, control and handling of containers; and recommend actions to resolve the problems;
4. Determine by echelon, the classes, subclasses, commodities and items of supply which are feasible to containerize;
5. Define requirements for management and control of containers and their contents;
6. Evaluate and quantify requirements to support concepts and applications; and
7. Develop data to provide the basis for modifying organizations to support a container system.

The study has three main parts that considered containerization, impacts of containers on the supply system and impacts of containers on the transportation system. The container system was to be flexible to support any operational environment, although the basic model considered a 17-division force in a mid-intensity conflict. The study also assumed that resupply would be containerized to the maximum extent.

The containerization substudy addressed container standards, movement and handling of containers, containerization of cargo, and commercial trends in containerization. The supply substudy analyzed and evaluated the potential use of containers, and developed concepts, doctrine and organizational and equipment requirements. Supply flow concepts, distribution constraints, container operations and workload requirements and management and control were addressed. The transportation substudy included concepts and organizational and materiel requirements to develop a transportation system capable of managing, handling and transporting containers.

Three distinctive container distribution system patterns were developed which could be applied depending upon combat intensity. The pattern which TRADOC determined was optimum featured the highest volume of materiel delivered in containers to the most forward echelons. In some cases, the use of TRICON (8'x8'x6.6') containers was assumed, but in most cases military and commercial 20- and 40-foot containers were employed.

The Army in the Field Container System Study included a detailed analysis of the impacts of containerization on the force structure. The container distribution system was planned for integration with the existing supply and transportation systems and would impact these systems by requiring some new operations and organizations. The study identified materiel handling equipment that would be required to support containerized distribution (four sizes of forklifts, three types of cranes, a loading ramp and a self-loading container side-loader truck). Transportation equipment that would be required, as well as a family of military containers consisting of ammunition vans, 20- and 40-foot dry vans, TRICONs and refrigerated vans, were also identified.

The study identified 22 transportation and supply unit types that required modification of missions, capabilities, operations and equipment. A new unit was proposed--a transportation terminal service company (container) (TOE 55-117H420). Details on the proposed unit included targeted throughput capability (discharge 390 containers and simultaneously backload 390 containers, or discharge 720 containers, or backload 720 containers) with a planned strength of 254. This unit in a LOTS operation would discharge or throughput 300 containers. The expected number of such units to support the container-oriented system was not specified. Therefore, matching unit capabilities with movement requirements, i.e., force structure impacts for levels of containerization, were not addressed.

Thirty field manuals and two technical manuals would be affected by the implementation of the container distribution system described by TRADOC, as would 23 training publications. The study also identified 28 subject schedules and 25 training tests that would be affected.

In 1981, the Study of Army Logistics - 1981 addressed the status of the containerization in the logistics system. By that date, concepts and doctrine for resupply had been developed and published in 1981 in the "capstone" doctrinal manual, Movement and Handling of Containers in the Theater of Operations (FM 54-11). The field manual departed somewhat from the preferred container distribution pattern developed in the Army in the Field Container System Study in that no 40-foot containers would be delivered to the Division area, although they would be used for the inter-theater move, and no containers smaller than 20 feet in length would be used. (The Army in the Field Study had recommended the use of TRICONs in some situations). Also, container movements would not move as far forward as the user. Distribution patterns by supply class are presented in FM 54-11, and the following estimates are made of supply class containerizability:

CONTAINERIZABILITY, BY SUPPLY CLASS

<u>Class</u>	<u>Description</u>	<u>% Containerizable, 20-Foot Vans</u>
I	Subsistence	100%
II	Indiv. Equipment	100%
III	POL (Pkged)	100%
IV	Construction Materials	75%
V	Ammunition (Conventional)	100%
VI	Personal Demand Items	100%
VII	Major End Items	20%
VIII	Medical	*
IX	Repair Parts (Non-ALOC)	80%

* Not addressed in FM 54-11.

By 1981, equipment, including various forklifts, cranes, tractors and ramps, had also been developed to handle, move and unstuff containers. These items had been allocated for distribution to Communications Zone (COMMZ), Corps and Division Support Command (DISCOM) areas. Actions had been initiated to procure and field the items. Line-haul tractors and semi-trailers were also in production with fielding expected in 1982. New equipment items were to be distributed to twenty-nine unit types, including to the Transportation Terminal Service Company (container) (TOE 55-119), proposed in the Army in the Field Study Container System Study. (Note: Impacts of containerization on supply units were not included in the Study of Army Logistics - 1981, but FM 54-11 indicates that the container doctrine would impact fourteen general and direct support units with container-related handling requirements). The study notes, however, that support for each theater in terms of expected containerization levels (in percent) should be specified so that the force structure could be adjusted, if required.

In 1983, the Army's MERADCOM reported on the Army's capability to implement the resupply container doctrine specified in FM 54-11 (Survey Report on the Status

of Container Integration in the Army Supply System). While hardware system integration problems were the primary focus, MERADCOM also assessed policies, doctrine and operational concepts for containerized supply movements, defined DOD elements involved with the activities that impacted the container program, identified developmental programs and studies, and listed problem areas in the container program. Areas to be considered in identifying problems included policy and doctrine, operations, equipment, organizations and command viewpoints (which might differ from established doctrine).

Based largely upon interviews, MERADCOM found:

1. The most serious unresolved problems related to containers and container handling were associated with LOTS operations in undeveloped areas,
2. No cited evidence of problems associated with the availability of containers or containerships,
3. Requirements for a system for real-time tracking of containers moving through the system, a system to speed unstuffing containers, a side-opening container, and improvements to internal restraint systems and the M872 trailer;
4. No cited problems associated with the wartime movement of containers from CONUS to overseas ports;
5. No cited problems with the availability of ports in the European theater for discharging containers, and
6. Adequate in-theater handling capability for wartime resupply operations, assuming programmed procurements of equipment.

Current expected levels of containerization for Army resupply are included in the report, Unit Productivity Transportation Study (1983). These data were extracted and provided to the TSC study team by the Department of the Army, Deputy Chief of Staff for Logistics (DA DCSLOG). The expected resupply cargo

profile and the expected levels of containerization are:

- o 50% ammunition (65% breakbulk and 35% containerized)
- o 25% major end items (100% breakbulk)
- o 25% other (20% breakbulk, 80% containerized)

Force structure requirements are determined in part by these factors. Impacts on the required force structure, i.e., number and capabilities of terminal service and terminal transfer units to move containerized cargo in theater port areas, if the level of containerization increased, would have to be estimated.

4.3 Containerization of Ammunition

Ammunition fits readily into a container, and due to safety and security requirements is an excellent candidate for rapid intermodal throughput. This section describes past efforts and current issues in developing a containerized ammunition distribution system for the Army itself and for the joint community with the Army as the lead Service.

4.3.1 Ammunition Concepts and Doctrine

The first shipments of containerized ammunition arrived in Vietnam in January 1970. This Test of Containerized Shipments of Ammunition (Operation TOSCA), employed 226 new 35-foot Sea-Land containers and demonstrated the efficiency of containerization. The Army procured 4,500 MILVAN containers in 1970 to support the Containerized Ammunition Distribution System. The ammunition MILVANs are ISO containers equipped with restraint hardware consisting of eight slotted steel rails permanently installed in the container wall. Twenty-five adjustable cross bars are inserted into the rails to hold the cargo in place. The MILVAN is intended for inter-theater transport and for line-haul operations. Two tests reported in, Ammunition Container Criteria (MTMC/TEA - 1970) and Optimum Size Container (Army Materiel Command Ammunition Center -

1973) had determined that the 8'x8'x20' containers were the best size for ammunition shipments.

The Army developed concepts and doctrine for containerizing ammunition, and reported the results in, Containerized Shipment and Storage of Ammunition (1977). The study builds upon the concepts for a container distribution system developed in the Army in the Field Container System Study by providing a detailed refinement for shipments of ammunition. Flexibility to use both breakbulk and containerized methods was stressed, although the goal was to maximize container use. Containerized shipments were not expected to go as far forward as the user, and the CONUS distribution was not addressed. Theater force structure impacts were outlined as were required changes in equipment, field manuals, circulars, training programs and training tests. The containerized ammunition doctrine was included in Movement and Handling of Containers in the Theater of Operations (FM 54-11), as described in Section 4.2, in 1981.

4.3.2 Army as Lead Service for Joint CADS

In 1975, the Army was designated as the Single Manager for conventional munitions, with the Army Armament Materiel Readiness Command at Rock Island as the single agent. The Single Manager was charged with developing a total ammunition distribution system and with responsibility for tri-service containerization of conventional munitions. An implementation plan of a joint effort, with oversight by the JCSG, was developed to ensure a coherent systems approach to deliver containerized ammunition from source to user. Separate Service efforts were to be centralized for monitoring, coordination and management.

The Joint Logistics Commanders approved a study in 1975 (Definition of Joint Conventional Ammunition Containerization System Concept including Unification of Containerization Requirements) calling for a joint effort at defining concepts and requirements. The Program Management Plan for Containerized Ammunition Distribution System Development (Conventional Munitions) was published in 1978 with the Project Manager for the Army Container-Oriented

Distribution System (PM ACODS) as the focal point for planning, coordinating and integrating CADS development. The Navy, Air Force and Marine Corps were responsible for equipment requirements and programs assigned by the JCSG.

The effort focused upon developing the following subsystems: (1) container subsystem, (2) container control subsystem, (3) source subsystem, (4) CONUS line haul subsystem, (5) CONUS port subsystem, (6) ocean surface movement subsystem, (7) air movement subsystem, (8) ports of discharge subsystem, (9) overseas line haul subsystem, (10) user subsystem, and (11) common equipment subsystem. The project was scheduled for completion by 1983 (except for CONUS depot modernization).

While the management plan addressed the various system segments, in 1978 the GAO evaluated DOD's development of a containerized ammunition system (Progress Made and Improvements Needed in Developing a Containerized Ammunition System). DOD felt the SMRP-82 and SMRP-83 studies had validated the requirement to increase the capacities at CONUS ammunition terminals based upon expected mobility requirements. The GAO felt, however, that plans for increased prepositioning of ammunition may have invalidated the need for increased port capacities by reducing the sealift requirement. More generally, GAO felt that system throughput requirements had not been adequately defined and, therefore, system capabilities could not be planned. In addition, GAO felt that cost disincentives for using containers in peacetime were resulting in a system that did not resemble the wartime one, and that practice with commercial containers for various types of munitions shipments was needed.

The 1983 CADS Management Plan continued the efforts begun in 1978, but the PM ACODS had been disestablished in 1979 and the Army Materiel Command (AMC) became the lead for the CADS program. The 1983 plan also addressed initiatives for all Services, and is currently in effect.

The major program areas of the 1983 CADS Plan include:

1. Provide CONUS plants and depots with high volume capability to handle and ship ammunition by container and breakbulk methods,

2. Assess current and projected capability of commercial carriers to transport munitions and develop alternatives for improvement when inadequacies found,
3. Develop ocean terminal modernization and maintenance plans,
4. Develop safety criteria and standards for acquiring acceptable containerships,
5. Insure routine and emergency ship acquisition contracts, programs and plans,
6. Test and analyze responsiveness of container acquisition mechanisms for source stuffing,
7. Test and analyze the commercial container fleet and project safe container availability,
8. Compare wartime requirements with container availability and container handling capability,
9. Develop restraint systems, inspection handbook and operational procedures for use of commercial containers,
10. Develop facility modernization improvement projects,
11. Insure that analysis of current and projected capabilities of commercial carriers includes movement of essential civilian goods, general cargo as well as ammunition,
12. Develop and test special requirements for containerized storage of ammunition,
13. Determine methods to prevent explosive incidents in railcars, in ports and on ships,

14. Identify equipment requirements and develop or procure equipment necessary to handle and transport containerized ammunition,
15. Develop air transport capability for moving containerized ammunition, and
16. Test and evaluate organizational suitability of ammunition supply units to handle, store and transport containerized ammunition.

In 1984 the Program Manager for Ammunition Logistics (PM AMMOLOG) was established at the Picatinny Arsenal (under AMC) to develop an integrated Ammunition Logistics Improvement Program. While AMC is still the proponent for CADS, PM AMMOLOG has focused increasingly on the use of containers in the ammunition logistics system.

4.3.3 Use of Commercial Containers for Ammunition Movements

The DOD Project Manager for a Container-Oriented Distribution System saw ammunition movements as a critical application of container use. And, as noted in section 3.0, the difficulty of integrating commercial containers into CADS was cited as a major reason for extension of the PM for an additional year (from 1974 until 1975). In 1980, only irregular shipments of containerized ammunition using commercial vans are made--for the Army, Marine Corps and the Air Force from Concord NWS to Alaska and Hawaii.

The MILVANS were intended to be a nucleus fleet for containerized movements of ammunition, with additional capacity provided by the commercial fleet. The use of commercial containers requires, however, that the container itself and the internal restraint system meet standards to ensure safe movements on the CONUS line-haul, through the port, and aboard the vessel. By 1978, the MILVAN was the only container approved by the Association of American Railroads and Coast Guard for the transport of ammunition.

Starting in August 1978, trial shipments of live ammunition in commercial containers were made under the direction of the PM ACODS. The goal of the tests was to evaluate the restraint systems, and the time, cost and labor requirements. The first test of eighteen containers used the Navy-developed

Internal Restraint System (IRSKIT). In 1979, the Army Wooden Dunnage Restraint System was evaluated in a test shipment of 160 containers. The tests found both restraint systems satisfactory. Currently, several blocking and bracing techniques have been approved, most for 20-foot, end-opening containers. A listing of approved designs is contained in DA PAM 75-5, "Listing of Storage and Outloading Drawings for Ammunition." The Army Defense Ammunition Center and School in Savanna, IL, develops designs for common-user ammunition for which the Army is single-manager.

In addition to the restraint system, the condition of commercial containers for shipping ammunition is also regulated. The Coast Guard standards for such shipments, issued first in October 1978 (CGA 040-78), required that the containers "must be new or shall be in every respect equivalent to new containers, i.e., shall not have been structurally damaged or repaired, nor have been refurbished or reconditioned." Structural components could have no damage such as dents and punctures, and the container had to be watertight.

In response to requests by the Navy, which believed the standards too stringent thereby making acquisitions from the commercial fleet difficult, the Coast Guard issued a revision of its standard in 1979 (CGA 017-79). The stipulation that containers for military shipments be "new or ...equivalent to new" was deleted; the new standard also said containers had to be "weathertight" rather than "watertight." The definition of structural members was limited, and dents in structural members was permissible to a depth of 3/4". Restrictions in the kind and number of structural repairs was redefined.

The DOD's own draft Military Handbook for Inspection of Commercial and Military Intermodal Containers (MIL-HDBK 138 AR, December 1977) was used to select containers for the 1978 test of moving live ammunition. Eighty containers were inspected to find eighteen acceptable ones. In 1979, using a simplified/modified Military Handbook approved jointly by DARCOM and the Coast Guard, 304 containers were inspected to find 34 acceptable for the test.

The Coast Guard regulations for the condition of containers have had three more revisions since 1979, and are still more stringent than the industry standard (promulgated by the Institute of International Container Lessors--IICL) for

acceptable condition for carrying any commodity. The military inspection standards are currently in draft form and differ from both the Coast Guard and industry standards.

In 1987, the Transportation Systems Center completed a study for PM AMMOLOG on the inventory, availability and condition of standard, end-opening, 20-foot - containers. The results showed:

1. An inventory of approximately 820,000 U.S.-owned containers,
2. Most U.S.-owned containers leased to foreign carriers,
3. 100,000 containers off-hire in CONUS available for immediate use,
4. Approximately 50 percent of the off-hire containers, based on sampling in six ports on three coasts, acceptable for carrying military munitions under Coast Guard criteria.

The most recent test of commercial containers was conducted by PM AMMOLOG in November 1987. Five types of ammunition were transported in flatracks, open tops, MILVANs, side openers and standard 20-foot containers to five sites in the Federal Republic of Germany. Blocking and bracing designs were developed for each ammunition-container pairing. The goal of the test was both to evaluate the use of standard and specialized containers for efficient shipping by matching the commodity with the container and to evaluate system impacts of using the containers.

The results of the test established:

1. Preferred containers for each type of ammunition for efficient cargo carriage and unstuffing,
2. The basis for a pilot program to use standard and special containers to supplement the MILVAN fleet,

3. General issues and concerns that needed to be addressed, e.g., container inspection criteria, limits in the transportation system,
4. The need to work with industry to ensure that DOD container requirements can be met and that information is shared regularly,
5. The need to use containers as the "strategic envelope" that interfaces with all equipment so that there are no limitations by location.

There is an open issue connected with item 5, above, which has important long term implications. A major Army munitions logistic procurement, the Palletized Loading System (PLS), includes self-loading (i.e., self-sustaining) trucks and 8'x8'x20' flatracks for the munitions. These flatracks are not now designed to ISO standards, although there is internal debate about modifying the design to incorporate ISO compatibility. If ISO compatibility were incorporated into the system, two major advantages would be available to logisticians and field commanders: first, ISO compatibility would permit source loading of munitions onto PLS flatracks in CONUS and direct shipment through to users in theater. Second, theater logistics commanders would have the flexibility to use PLS self-sustaining trucks to handle MILVANS or standard 20' containers in forward areas. Focusing the PLS system on a non-standard frame dedicated to munitions appears to be an example of "stove-pipe" logistics intended to optimize a single part of the logistic mission without consideration of impact or potential value in other areas. Given the overall goal of optimizing the throughput of materiel in wartime in a container-dominated environment, it is worth high level review and consideration to include ISO compatibility in the PLS program.

4.3.4 Ammunition System Analysis

While MOTSU had a container capability as early as 1970, the increasing predominance of containerships in the commercial fleet has necessitated continuing consideration of the container outload capability. As noted in the discussion in section 4.1.1, the SMRP studies encouraged the use of containers for ammunition shipments and the MOTSU capability was increased from 500 to 1,000 containers per day. Additionally, trade-offs of ammunition and unit

equipment containerization (as they relate to surface lift utilization) have been considered.

Ammunition shipments, because of their hazardous nature, pose additional outload problems. Shipments currently outload through MOTSU, Earle, NJ, and Concord, CA. Recently, attention has refocused upon the optimal level of containerization, enhancements required to achieve it and the distribution system impacts.

The Korean Ports and Transportation Systems Capability Study (1985), prepared by MTMC/TEA, indicated the need for a west coast ammunition container vessel support system (CVSS). In 1987, MTMC/TEA completed an detailed analysis to augment the findings of a requirement for a west coast CVSS or other CONUS ammunition port enhancements to support the outload of containerized ammunition. Based upon a global scenario defined by the Joint Program Assessment Memorandum (JPAM - FY92) and using the RAPIDSIM, the analysis, reported in the West Coast Container Ammunition Port Requirements Study, addressed the impacts of various changes to outload capability and level of containerization on closure time.

A base case of 50 percent ammunition containerization showed that two additional CVSSs (one on each coast) and four additional breakbulk vessel support systems are needed to support the JPAM - FY92 ammunition requirements. Closure time was significantly improved with this added capacity.

The analysis also looked at the impacts of increasing levels of containerization. Two additional CVSSs on the east coast and one on the west coast are required to increase containerization to 70 percent. Sealift assets were used most efficiently at 70 percent containerization.

OJCS (J-4) has attempted to include the requirement for a west coast CVSS in the Defense Guidance. The CVSS will be included as planning guidance for further study rather than as a mobility midterm objective. A current MTMC/Maritime Administration effort is examining the feasibility of using commercial ports for ammunition outload, but it is not expected that this will

prove to be a viable alternative to a military containerized ammunition outload facility.

At the direction of the Director of Logistics (OJCS - J-4), and as a follow-up to the West Coast Container Ammunition Port Requirements Study and the 1987 Conference of Logistics Directors, a Container Ammunition Transportation Systems (CATS) Study is being undertaken currently by MTMC/TEA. The purpose of the study is to determine the capability of the entire conventional ammunition distribution system, with emphasis on container handling capability at nodes and through the distribution system. CONUS and OCONUS capabilities are being evaluated.

4.3.5 Current Status and Summary of Ammunition Containerization

1. Flexibility achieved using various commercial container types, instead of just MILVANS, has been demonstrated but not yet incorporated into CADS. Commercial containers have not been integrated into the regular monthly ammunition shipments from MOTSU.
2. An open issue exists pertaining to ISO compatibility and interoperability of the Palletized Loading System. ISO compatibility would permit source loading of munitions onto PLS pallets in CONUS and direct shipment through to users in theater. Also, theater logistics commanders would have the flexibility to use PLS self-sustaining trucks to handle MILVANS or standard 20' containers in forward areas.
3. The MILVAN fleet has nearly exceeded its useful life, and the size and composition of a replacement fleet must be examined. The extent to which commercial containers that are used would impact the requirement for the organic fleet.
4. Standards of condition limit the available supply of commercial containers. Although revised several times, the Coast Guard standard is currently more stringent than commercial standards for a container the IICL judges safe for the transport of any commodity.

5. There is no current funding for development of a west coast military container outload port despite studies demonstrating the requirement for the capability.

4.4 Air Movements of Containerized Resupply and Unit Equipment

At the outset of developing a container-oriented distribution system, integration of containers into the airlift system was assumed. In 1971, the Air Force-led Land-Air-Land Task Group was formed to address issues around this integration. In 1970, however, MTMC/TEA sought to determine if air cargo was generated in sufficient quantities to use containers, and to determine the optimal size container. While the study (Air Cargo Containerization) addressed Service, DLA and GSA requirements, the Army originated the largest part (44 percent) of the requirement. And, while the focus was on peacetime shipments, integration of containers into the air system was seen as a step toward having a system capable of transitioning to wartime.

The TEA study did not address operational problems such as:

1. Excessive tare weight of containers,
2. Incompatibility of the Air Force's 463L pallet system with containers,
3. Retrograde of containers,
4. Procurement and maintenance of the fleet, and
5. Ownership and accountability responsibilities.

Using a fleet of C-141 and C-5 aircraft, the daily requirement for moving cargo in 8'x8'x10' and 8'x8'x20' containers was compared. Eighteen consignors were grouped into seven consolidation areas to maximize cargo generation, but the use of 8'x8'x20' containers was not justified due to low volumes. The study recommended that the Army initiate action to design, develop, and procure 8'x8'x10' air/land containers. Besides being the largest volume, Army shipments tended to be CONUS inland point to overseas inland point movements,

rather than terminal-to-terminal or port-to-port movements. Therefore, the Army could best capitalize on the efficiencies of intermodalism.

While the Air Force during the 1970s addressed issues related to the air movement of cargo for all Services, this study team found no further Army activity related to resupply cargo movements by air until a joint Army/Air Force test in 1981-2. In the Master Plan for the Container Oriented Distribution System, MAC was responsible for implementing and managing a system to handle intermodal containers and shelters. Therefore, MAC's purpose for conducting the test was to evaluate its ability for moving air/land containers and to assess the cost impacts of containerization.

The Department of the Army's Materiel Development and Readiness Command (DARCOM) indicated a potential application for containerized airlift to support Army ALOC (Air Lines of Communication) cargo moving between New Cumberland Army Depot and USAREUR supply support activities in the Federal Republic of Germany. Impacts of using containers to support retrograde movements were also estimated. For the test, MAC leased twelve commercial light-weight air/land containers (tare weight 2,100 - 2,600 lbs.). The use of pallets was compared to the use of containers throughout the test.

The results of the test showed:

- o In peacetime, less cargo could be moved in containers than pallets. In wartime, due to increased payloads, more cargo can be moved containerized than palletized, except for a 747 aircraft where more cargo could be moved by pallet than container in peacetime and in wartime.

- o There were time savings over pallets for stuffing a container at the depot and for unstuffing at Dover, AFB. There were time costs at Rhein-Main and Ramstein for stuffing containers, but no significant difference for stuffing/unstuffing for Army units in Germany.

- o On-hand MHE was suitable for handling small quantities of containers, but more would be required to meet wartime requirements.

- o Additional costs were incurred for moving cargo in containers due to the tare weight, which exceeded that of pallets.

- o MAC savings, if any, were minimal for peacetime moves, but MAC felt the need to practice for wartime.

- o MAC recommended a peacetime program to both train personnel and to identify system constraints and required enhancements to meet surges in wartime.

- o MAC requested OASD approval to purchase 50 air/land containers to begin a regular airlift program for peacetime ALOC cargo.

MAC received procurement authorization from OASD, but the containers were never acquired and the airlift of containerized ALOC cargo did not occur. It must be noted that this test was conducted using light-weight air/land containers which seemed to be growing in commercial use, but which have not gained widespread acceptance. If MILVAN-weight containers had been used, the tare weight penalty would have been more substantial causing increased cost. Therefore, care must be used in extrapolating these results to other container types.

Current Army policy does not address the extent of container use for air shipments, although guidance from the Army during TSC's 1986 study, Air Container Movement Requirements in the Year 2000, indicated that currently little if any Army resupply is expected to be containerized for air movement, although containers and tactical shelters, considered unit equipment, may require airlift. (For further study results, see Section 7.0).

4.5 Container System Evaluations

Following the Study of Army Logistics - 1981, DA DCSLOG became active in addressing containerization issues. DCSLOG's 1983 study, the Assessment of the Study of Army Logistics - 1981 either confirmed, rejected, or expanded the recommendations of the 1981 study, and initiated and tracked logistics action items. Several recommendations related to system-wide containerization were included. Three of particular interest are:

1. Implement standardized containerized cargo planning assumptions,
2. Direct MACOMs to develop time-phased capability to handle a prescribed level of containerization, and
3. Support exploitation of container systems in wartime.

The rationale for the first recommendation is to ensure that Army force structure could accommodate an expected percentage of containerization, by theater and OPLAN. For transitioning to war, the second recommendation would ensure that container-related equipment was positioned to handle the expected level of containerization. At the time of the Assessment, there were neither long-range goals for containerization nor mechanisms for long-range containerization planning. Most theater containerization policy was specified by the supported CINC through JOPS, but this provided only near-term planning. Therefore, DCSLOG recommended that planning guidance relative to a prescribed level of containerization be keyed to the available fleet capabilities to support containerized movements to ensure maximum utilization of the vessels. This represents a reverse approach to having the CINCs determine the level of containerization.

In a September 1981 memorandum, DCSLOG requested that OJCS (J-4) undertake a joint study to assess and project sealift requirements and capabilities. DCSLOG also requested in March 1982 that J-4 develop long-range planning guidance by theater as a benchmark for developing the Services' container policies.

Pertinent to the third recommendation, DCSLOG cited several on-going efforts, including MTMC's development of a container control system to manage the world-wide movement of containers. (See Section 9.0 for further discussion) Also, MOTSU's container handling capacity was being upgraded to 1,000 containers per day and a CADS had been developed and implemented. A shortfall in the Army's containerization program was identified, namely the lack of forward stationed units having container handling equipment in Korea and Europe. Host nation

support agreements were expected to ameliorate the shortfall in Europe, with long-term facility improvements planned for Korea.

DCSLOG's activity in addressing containerization issues resulted in two studies by the Army's Concepts and Analysis Agency. The two entitled, Containerized Cargo Distribution Analysis (COCADA) (U) and Containerized Cargo Distribution Analysis - Southwest Asia 88 (COCADA SWA 88) (U), were completed in 1983 and 1984, respectively. The goal of the COCADA study was to develop and demonstrate a methodology for determining the most effective use of containers for cargo distribution for both resupply and unit equipment during contingency or mobilization operations. For the first time, the focus was not on the strategic lift but on the impacts of containerization on intra-theater transportation networks. Following the demonstration of methodology in COCADA, COCADA SWA 88 used an adaptation of the Simulation for Transportation Analysis and Planning (SITAP) model to estimate the impacts of various containerization policies on theater delivery capabilities. The study evaluated these policy issues specified by DCSLOG:

1. Levels of containerization,
2. Echelon to which containers are distributed,
3. Day on which retrograde of containers begins,
4. Time allowed to cycle containers, and
5. The day containerized cargo is introduced into the theater.

For some analysis cases, cargo handling and transportation units were held constant to identify critical constraints to move a fixed amount of cargo. In other analysis cases, containerization was held constant and the force structure varied until movement requirements were met. The results of the study were to provide the basis for capital investments to acquire the optimum mix of equipment and units to accomplish theater distribution. The COCADA efforts represent an effort at addressing containerization at a level not previously modeled.

In 1983, MTMC/TEA conducted an analysis at the request of the Eighth Army to evaluate the adequacy of the ports and transportation system in Korea to support peacetime and emergency military requirements. The Korean Ports and Transportation Systems Capability Study (U) represents the most complete system origin-to-destination analysis identified during the course of this containerization study.

The analysis includes intra-CONUS and intertheater lift requirements to support an OPLAN, and compares outload capabilities to requirements. Containerization is addressed in relation to installation and depot outloads and line-haul capabilities. Required capabilities for containerized ammunition outload are also addressed. Recommendations based upon possible shortfalls were included.

The study also contains a detailed survey of 22 Korean ports to serve as a reference for port characteristics that impact unit equipment, resupply and ammunition deliveries. The study also established priority uses for each port based upon capabilities, identified alternative ports and berths, and developed throughput estimates. TEA developed a port ranking scheme based upon characteristics of the ports, including links to intratheater line haul infrastructure.

The adequacy of the transportation systems in Korea for moving unit equipment, general resupply and ammunition to upcountry employment, reception and staging sites was estimated. Five (of sixteen) major findings relate to containerization as do seven (of fifteen) recommendations for action.

DCSLOG continues to address system-wide impacts. In-progress is the development of the Army Strategic Mobility System Assessment (ASMSA) by the Army Concepts and Analysis Agency to link existing automated systems to model the world-wide transportation system to determine impacts of budgetary changes on movement capabilities.

The development of containerization policies must be based upon current or planned system performance. Therefore, the system must be analyzed to determine the "weak link" that will constrain throughput. The Army has

developed methods for analyzing segments of the container distribution system. Several automated tools for beginning the iterative process of determining optimal container use through systems analysis are largely in place. Consistent data collection, followed by definition of alternative scenarios and analysis of system impacts can result in container policies that optimize available resources for various deployment scenarios.

4.6 Summary Observations/Issues

1. The Army developed detailed resupply concepts which resulted in a coherent doctrine that has been implemented through adjustments to the force structure, transportation and supply systems. Expected wartime containerization levels are planned, and equipment has been programmed to meet planned requirements. Theater requirements have received the most attention.
2. After the disestablishment of the Army-led DOD Project Manager for a Container-Oriented Distribution System, the Army had a PM for its container efforts (PM ACODS) from 1975-1981. Following the Study of Army Logistics - 1981, DA DCSLOG became active in containerization issues and sponsored the development of automated analytic support systems. Current renewed interest in containerization by DSCLOG, as exhibited by the formation in 1988 of an Army Containerization Steering Group and through the planned revision of AR 56-1, is expected to enhance intra-Army coordination on the remaining issues.
3. Impacts of containerizing Army unit equipment have not been determined. No current policy addresses this issue, although the revision of AR 56-1 is expected to state Army policy for the first time. Unit equipment containerization is problematic because it requires that equipment not suited for containerization be planned for movement in a limited surface fleet consisting largely of container ships. Unit equipment containerization could impact the following:

- Outload capabilities in CONUS

- Requirements for and availability of containers and CONUS line-haul assets
- Facility readiness for containerization
- Appropriate equipment and training
- Unit integrity
- Theater force structure, port and line-haul capabilities for handling an increased level on container throughput
- Efficient use of ships

4. A system-wide approach to examining container use has not been implemented, although several automated systems within and outside the Army have been developed to permit such analyses. Several efforts of this type--COCADA, CRAS (in-progress), MTMC/TEA's Closure study and ASMSA--can enhance the development of a container policy based upon expected impacts through the system.

5. Open issues remain around the containerized ammunition distribution system. Commercial containers have not been regularly used in CADS. Therefore, smooth transition into the transportation and supply systems under emergency conditions is unlikely. Also, given the overall goal of optimizing the throughput of materiel in wartime in a container-dominated environment, it is worth high level review and consideration to include ISO compatibility in the PLS program.

6. The requirement to airlift containers and ISO tactical shelters is not addressed in Army policy. While the requirement is a small part of the total strategic lift, rapid early deployment could be hindered if MAC cannot accurately plan for handling containerized Army supplies and equipment.

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5.0 NAVY CONTAINERIZATION

This section describes the Navy's container programs to support its units. Navy programs related to over-the-shore container delivery are discussed in Section 8.0.

In wartime the Navy has two primary strategic functions: first, its combatant function to seize and maintain control of critical sea lanes of communications (SLOC) and adjoining land areas; and second, to provide common-user strategic sealift, through the Military Sealift Command, for equipment and supplies to military forces.

Unlike the Army and the Marine Corps whose land based operations are more amenable to container use, the Navy's primary use of containers has been through an extensive shelter program supporting, mainly, aircraft and the Fleet Hospital Program. These are discussed below.

5.1 The Combatant Navy

The first and perhaps most visible role of the Navy is that of combatant. Combatant ships and sea-based aircraft are used to accomplish this mission. The sea-based combatants--Naval Battle Groups referred to as gray bottoms--receive general stores, e.g., food stuffs, personal use items, POL, and spares, etc., while underway from the Mobile Logistics Support Force (MLSF) station ships. This logistics support system is referred to as underway replenishment (UNREP). Currently, breakbulk methods rather than ISO containers are used for UNREP.

A series of studies in the early 1970s addressed the development of a containerized UNREP system. The studies either concluded that the use of containers and containerships for UNREP of combatants was uneconomical and operational infeasible, or funds for continued research and development were cut. In 1971 the Office of Naval Research (ONR) initiated a study, the results of which are reported in, Containerships Underway Replenishment: A Study of the Use of Containerships for Naval Underway Replenishment. The first part of the study assessed three primary factors impacting the feasibility of containership

UNREP: (1) current and projected technology as well as the operational capability of the merchant containership fleet to perform UNREP operations, (2) the technical problems with state-of-the-art systems, and (3) identification of additional systems capabilities and technologies necessary for optimal utilization of containerships.

Generally, the ONR reports concluded that Naval Combatants do not have adequate deck loading or CHE/MHE capacity to utilize containers safely or effectively. Therefore, materiel is transported in breakbulk aboard MLSF ships and transferred at sea to the combatants via a series of pallet-based transfer systems. Between the source and the combatant, advanced logistics support bases may provide transshipment points for supplies, received either breakbulk or containerized.

Although the combatants receive their material in breakbulk, the supplies are shipped both breakbulk and containerized in CONUS. Materiel is containerized at supplying activities if minimum cost is achieved. Line haul transportation is then provided by MTMC to the port of embarkation. At the port, any containerized materiel is unstuffed and loaded aboard the breakbulk MLSF ships.

MLSF vessels are both DOD- and commercially-owned vessels. A large number of breakbulk ships would be required to replenish combatants at sea in wartime. Therefore, the containership-dominated fleet (other than tankers) poses incompatibilities with planned MLSF UNREP operations in wartime.

Naval Sea Systems Command (NAVSEA) has pursued a number of systems that would adapt containerships to MLSF ships. Currently, one R&D program--the Merchant Ship Naval Augmentation Program (MSNAP)--addresses strategic sealift and UNREP. The MSNAP Program concept would install aboard containerships the Container Strike-Up System (CSUS). The CSUS is a series of elevator systems giving containerships the capability to stow, unstuff, and deliver materiel in breakbulk form to combatants equipped with UNREP stations. The CSUS, developed by NAVSEA, can strike up or strike down breakbulk cargo, including ammunition. When installed in containerships with flatracks or SEASHED deck systems, MHE, and other UNREP support systems, a non-self-sustaining containership can stow

and transfer breakbulk cargo to other vessels at sea via Standard Tensioned Replenishment Alongside Methods (STREAM) rigs. A prototype and land tests were completed in 1987, and NAVSEA is currently soliciting CINC input and requirements to determine future planning and POM submissions.

Programs similar to MSNAP are under discussion; however, funding and operational constraints have continued to limit the development of a operationally tested and fully effective container-oriented UNREP system. Therefore, the focus has been on using containerships in a breakbulk capacity.

5.2 Shelter Programs

The primary use of ISO containers by Navy units is for tactical shelters. The largest users are the Navy Fleet Hospital Program and sea-based aircraft support units. Navy shelter programs, such as the Naval Air System Command Mobile Facility Program which provides a variety of solutions to Navy and Marine Corps operational functions conducive to containerization, are described below. Integrated complexes of shelter units now support numerous functions necessary to support tactical system during combat operations.

5.2.1 Fleet Hospital Program

The Navy's largest user of ISO shelters is the Fleet Hospital Program. In addition to the shelters in current inventory (see Appendix 1), an additional 6,500 ISO shelters are programmed for procurement. The program is developing 23 hospitals, each of which requires approximately 400 shelters. Therefore, the program anticipates a requirement of 9,200 shelters. CHE/MHE requirements, such as Rough Terrain Forklifts and Rough Terrain Container Handlers (RTCHs) to support the program are also planned. Current acquisition plans include 3,500 tactical shelters in 1988 and then 500 annually until 1994.

Although most of the Hospital Program's materiel can be containerized, some cannot. Much of the outsized equipment, however, such as ambulances and mobile generators, can be accommodated on flatracks or in SEASHEDs, or placed at prepositioned (global stationing of materiel) or near-term prepositioned locations (specific geographic stationing).

5.2.2 Seabased Aircraft Shelter Program

Currently, aircraft carriers are the only combatant ships that utilize containerization; an ISO tactical shelter program supports ship-based aircraft. The ISO shelters are used to store parts and provide specialized maintenance and general support equipment (GSE) shops, e.g., for command, control, and communications, and electronic countermeasures equipment. Containerized maintenance and GSE shops have been deemed a cost effective means to provide increased mission flexibility in a 1972 Naval Air Command (NAVAIR) study reported in, U.S. Navy Containerization Evaluation.

The concept of shelter use for ship-board aircraft provides one set of outfitted shelters per aircraft group. Each type of aircraft, e.g., fighter, interceptor, reconnaissance, requires a specialized set of parts and maintenance shops, as well as GSE to maintain a state of flight-readiness. When the aircraft are "changed-out," that is rotated out of service to home base or to another vessel, the containerized shops are transported with them. This procedure saves substantial costs through redundancy avoidance. Only one maintenance and GSE shop for each set of aircraft is required, rather than duplicate facilities at home bases or on other aircraft carriers. The Navy's air forces also contain a significant number of outsized equipment, generally engines, and various types of support equipment and aircraft. Like the Fleet Hospital Program, these requirements are met with flatracks or SEASHEDs.

5.3 Naval Mobile Construction Battalions

The primary source of outsized unit equipment that is not part of the Navy's combatant forces is Naval Mobile Construction Battalions (NMCB/Seabees). Their basic table of allowance (TOA) equipment weighs over 5 million pounds and occupies approximately 500,000 square feet. Three Seabee Battalions are assigned to each Marine Expeditionary Force (MEF). According to a 1983 technical report entitled, System Definition for Containerizing the Assets of Naval Mobile Construction Battalions, conducted by the Naval Civil Engineering Laboratory, Port Hueneme, California, over 95 percent of the items on the NMCB TOA can be containerized; however less than 50 percent by weight can be

containerized due to the very large and heavy support equipment e.g., heavy lift cranes, tractors, necessary to meet their mission.

Current planning for containerization is determined by a computerized packing model, based upon the NMCB standard TOA and called the TA01 Pack-up Model. Guidance for using the model is found in the NMCB Master Plan for Containers and Unit Equipment. Container transportation and handling is documented in the Seabees' Container Handling Handbook. Outsized construction equipment, primarily wheeled and tracked vehicles, are usually prepositioned on Ro-Ro vessels. Remaining outsize construction equipment and materiel, such as saw mills and lumber, is accommodated using flatracks and SEASHEDs.

5.4 Containerized Ammunition Initiatives

Currently, there is no written ammunition containerization policy within the Navy. As stated earlier, sustaining the combatant Navy by container for supplies appears technically and economically infeasible. Navy land forces such as the Seabees are supplied with ammunition by either Army or Marine Corps land combatant forces.

Where containerization of Navy ammunition is possible, the Navy coordinates with the Army to avoid duplication of effort. The Army, as discussed in Section 4.3.2, is the single manager for common user conventional ammunition and as such is charged with the responsibility for containerization efforts for these items. The study team did not identify any major Navy containerized ammunition programs that are currently underway, only a number of studies conducted in the early 1970s and some coordinated with the Army in the 1978-1979 time frame.

In 1971, the Naval Ordnance Systems Command issued the Technical Plan for Containerization of Naval Ordnance. The plan outlined a phased program for the development of a container system to accommodate ammunition. As part of phase I, Project Autumn Leaves was conducted in 1972.

Project Autumn Leaves entailed the simultaneous sealift of containerized and LASH transported Naval munitions. The ordnance was transported from both east

and west coast terminals, referred to as Autumn Leaves East and Autumn Leaves West, respectively. The test was the most extensive containerized ammunition sealift test conducted by DoD up to that time. The results of the study are documented in, Evaluation Report on Project Autumn Leaves (1972).

Project Autumn Leaves had three objectives: (1) to assess the logistics and cost advantages to containerizing ammunition at the port or at the point of origin; (2) to expand the use of containers for transporting Naval munitions and to familiarize Naval activities with the concept of containerization in preparation for a completely containerized system; and (3) to assess transportation rate structures and hardware systems installed at selected Naval activities.

The primary finding of Autumn Leaves was that there was a cost savings to transporting ammunition in ISO containers. However, cost savings were greater if munitions were stuffed at the point of origin rather than at the port.

Following Project Autumn Leaves the Naval Weapons Handling Center, Colts Neck, New Jersey, conducted a study to identify the optimal container size for transporting ordnance. A 1972 study entitled, An Optimization Study of Cargo Container Sizes for Ordnance, matched the sizes of ammunition used by the Services against commercially available containers. The study concluded that the 8'x 8'x 20' ISO container was the optimal size for ammunition transport.

Navy initiatives in containerized ammunition were coordinated with the Army after 1975 when the Army was designated the single manager for containerization of common user munitions. In the late 1970s, the Navy and Army coordinated on a series of blocking and bracing designs required by the Coast Guard for carrying ammunition in commercial containers. For example, the Colts Neck Center conducted a study in 1978 (reported in Development, Testing, and Evaluation of an Internal Restraint System for Transporting Ordnance), which detailed the design and test of the newly developed Internal Restraint System Kit (IRSKIT). The study assessed its use in an operational test of trial shipments to Europe. Testing of the IRSKIT prototype revealed that it could safely restrain ammunition in accordance with Coast Guard regulations.

A follow-on study in 1979 was also completed by the Colts Neck Center, Readiness and Implementation Study for a Reusable Ammunition Restraint System in Commercial Intermodal Containers, describes readiness options for the IRSKIT system in wartime. The study identifies and assesses a number of readiness strategies designed to ensure availability and installation lead time during a contingency. After evaluating five options, the study concluded that the most effective readiness strategy would be one that maintains an inventory of IRSKIT systems and begins production of new systems during wartime. To date, IRSKITs have not been procured.

In the mid-1980s, NAVSEA and Colts Neck did conduct research on modifying containerhips to accommodate elevator systems that could deliver breakbulk ammunition out of the ship's hold, thereby facilitating UNREP at sea for combatants. This program was also to be adapted for resupply of general stores but, as discussed in Section 5.1, research was discontinued due to funding cuts in the Navy R&D budget.

5.5 Strategic Sealift

In 1984 the Secretary of the Navy (SECNAV) made strategic sealift a Navy responsibility in addition to its combatant roles. Strategic sealift encompasses port-to-port transportation of equipment and materiel to military forces in both developed and undeveloped regions. The Navy's Strategic Sealift Program, OP-42, provides the ships, and cargo handling systems to meet this objective. In response to DoD policy and the predominance of containerhips in the commercial sector, the Strategic Sealift Program has and continues to develop systems to facilitate the use of containers and containerhips for surface lift.

5.5.1 Platforms

Strategic sealift relies on the availability and suitability of ships to meet military transportation requirements. OP-42, through the Military Sealift Command, utilizes both DoD-owned and chartered commercial vessels to meet lift

requirements. Generally, the ships that impact container utilization fall into two categories: prepositioned and sealift enhancement.

The prepositioning of Marine Corps, Army, and Air Force UE, and resupply is accomplished using a combination of self- and non-self-sustaining ships, including Ro-Ro, Lighter Aboard Ship (LASH), tankers, and breakbulk capable vessels. In addition to these prepositioned vessels, the Fast Sealift Ship (FSS) program began in 1981 with the purchase of eight SL-7 containerships for resupply. NAVSEA converted these commercially designed vessels to militarily useful ships enabling each vessel to accommodate containers, vehicles and breakbulk cargo.

Sealift enhancement ships generally refer to Aviation (T-AVB) support ships and auxiliary crane ships (T-ACS). The mission of the T-AVB class ship is to provide dedicated sealift for movement of an aviation intermediate maintenance activity to support the rapid deployment of USMC fixed and rotary wing aircraft units. The mission of the T-ACS is to provide a civilian-manned crane ship to offload containers and other outsized cargo from non-self-sustaining container or cargo ships offshore or in undeveloped or damaged ports.

5.5.2 Sealift Enhancement Features Program

Sealift Enhancement Features (SEF) are designed to modify commercial ships to meet military transportation requirements and missions. Although there are a series of SEF elements including specialized communications equipment and refueling rigs, the two enhancement features critical to containerization and the accommodation of outsized UE are flatracks and SEASHEDs. Current requirements for each were determined by the 1984 DoD Sealift Study. However, these requirements are expected to change based upon the findings of the ongoing Revised Inter-theater Mobility Study (RIMS) currently in progress.

Flatracks enable containerships to carry outsized cargo e.g., tracked and wheeled vehicles. Flatracks fit into the container cell guides and can be aligned in a containership to provide a clear decking for breakbulk loading of outsized cargo, which is lifted on and lifted off. Commercial flatracks have a capacity of 30 tons, whereas the Strategic Sealift Program's heavy duty

flatracks have a capacity of 60 tons. Flatracks that are not used for prepositioning or near prepositioning are maintained by MARAD/MSC at designated CONUS sites.

SEASHEDs also enable a containership to carry outsized military cargo. Measuring 40'L x 24'W x 12.5'H, SEASHEDs have work-through floors that permit level by level loading and unloading. The capacity of a SEASHED is 100 tons. Unlike flatracks which are portable, SEASHEDs are installed aboard vessels. Currently, there are four SEASHEDs aboard the Gopher State (T-ACS 4) and seven SEASHEDs aboard the Keystone State (T-ACS 1). Other installed SEASHEDs are aboard T-AKRs.

The listing below shows the number of SEASHEDs and flatracks on hand/under contract and planned through FY 1989, as of November 1987. (Note: Containership Cargo Stowage Adapters (CSSAs) are required to install the SEASHEDs. Clearly, development of the enhanced capability has not proceeded on schedule and fulfillment of the 1984 requirement is not expected in the 1989 time-frame.

	<u>SEASHEDs</u>	<u>CCSAs</u>	<u>Flatracks</u>
Planning figures based on 1984 DOD Sealift Study	2,000	670	7,000
Delivered/under contract thru FY 87	720	248	358
Awards planned FY 88	150	150	976
Awards planned FY 89	245	55	215
Actual hardware on hand to date (included in 1984 figures)	388	0	358

In addition to Strategic Sealift's ship developments and enhancement programs, several ship-to-shore systems have been developed, e.g., COLDS, COTS. These

are discussed in Section 8.0 covering Logistics Over the Shore Operations and in the documents abstracted in Volume III - Annotated Bibliography.

5.6 Management of Container Programs

The Navy currently does not have a written container policy; however, in accordance with DODD 4500.37 containerized delivery systems have been developed wherever they were deemed economically and operationally feasible. For example, the use of ISO tactical shelters are integral to some Navy programs and containerization of Seabee units has progressed. As discussed in Section 5.1, the combatant Navy does not currently utilize containers during peace or wartime. Current UNREP operations are not conducive to container use.

In 1980, the Container Oriented Network Distribution Analysis (CONDA) Program was developed by NAVSUP to provide the Navy with the capability to determine the extent, types, and manner in which containers should be handled and integrated into the Naval logistics system. CONDA had two objectives: to develop a database which addresses specific inland cargo movements, port handling and ocean freight container costs, and to develop an automated containerized cargo documentation system to track cargo from its origin to its destination.

The data developed under the CONDA program provided a management tool to assess efficient route patterns and rate structures. Once the baseline for CONUS container movements was established, the CONDA program was discontinued. The Program is described in a 1980 Naval Supply Systems Command (NAVSUP) report, Container Oriented Network Distribution Analysis System.

In addition to management tools and feasibility studies, the Navy developed written container policy in 1977. Naval Materiel Command Instruction 10580.2A, 26 April 1977, (Navy Container Programs) "established policy and procedures throughout the Naval Materiel Command (NAVMAT) for the planning, development, and control of Navy container programs...including related research, development and procurement of containers, CHE facilities, and interfaces." NAVMAT however has since been disestablished and the Instruction has been rescinded.

A new Naval Supply Systems Command Instruction (NAVSUP Instruction 10580.4A) has been drafted and is currently being staffed. The objectives of the draft Instruction are to maximize the use of containers where feasible, to administer a coordinated container program within the Naval logistics community, prevent duplication of effort, apply unique Navy and Marine Corps requirements for containers, and to ensure Navy adherence to DoD requirements that any container system developed and procured be compatible with current and forecasted transportation modes.

OPNAVINST 3900.27/AR 70-59/AFR 80-8/MCO 3920.5 is the joint regulation that establishes policy, procedures, organization and responsibility for an RD&E program to support the DoD tactical shelter program. Initiation of a tactical shelter program requires approval of the Joint Committee on Tactical Shelters (JOCOTAS) or waivers by OSD.

5.7 Summary Observations/Issues

1. The Navy does not currently have a Service-wide written container policy. although NAVSUP Instruction 10580.4A is currently being staffed.
2. The Navy generally has a decentralized containerization program. Its primary means of combat (gray bottoms and submarines) are not readily adaptable to container use. However, individual Navy activities, e.g., NMCB, NAVAIR, Fleet Hospital Program, have actively developed and implemented the use of containers where they appear to improve logistic support.
3. The Navy has two extensive shelter programs. The Fleet Hospital Program, based in Alameda, CA, is pursuing a considerable acquisition plan and has a program which includes specialized training facilities and doctrine development. Similarly, NAVAIR is pursuing the use of tactical shelters in support of the Navy's air forces. Both shelter programs are coordinating with the Army and Air Force through the Joint Committee on Tactical Shelters (JOCOTAS).

4. The Seabees have a developed container concept and currently containerize 50 percent of their UE by weight (95 percent of their items). Additionally, they have an automated packing model, a written master container plan, and accompanying container doctrine.

5. If UNREP continues to be primarily breakbulk, the number of breakbulk ships available for resupply of combatants in wartime will be critical as the Navy places an additional demand for these scarce ships. Assuming that the number of available breakbulk vessels continues to decline, the use of container ships equipped with SEASHEDs or MSNAP enhancements to deliver breakbulk cargo to combatants may be required.

6. Navy containerized ammunition initiatives have paralleled Army efforts for common-user munitions. Naval land forces that utilize common-user ammunition, generally the Seabees, are supplied by the assaulting land forces, either the Marine Corps or Army. Current specialized ammunition activities impacting container use is limited to discussions surrounding the further development of MSNAP. Although an internal restraint system was developed by the Navy and approved by the Coast Guard, commercial containers are not used for containerized ammunition shipments.

7. Adequacy of overseas Pacific ammunition ports/storage facilities to handle large volumes of containerized ammunition continues to be an unresolved issue. Developing a container ammunition port at NWS, Concord, CA, also remains an issue. The Navy would be responsible for funding that Container Vessel Support System.

6.0 MARINE CORPS CONTAINERIZATION

This section describes Marine Corps container initiatives and programs. In addition to providing a programmatic background to Marine Corps efforts, this section also addresses special Marine Corps container-related issues that apply to the Marine Corps/Navy interface in the amphibious environment.

6.1 Conceptual Background

Containerization poses a special set of inter-related problems for the Marine Corps, which must have the ability to respond rapidly to any contingency. This fighting doctrine requires a sustainable yet highly flexible logistics system. Since the early 1970s when containerization was recognized by the military as the dominant commercial trend, and when utilization of a container distribution system had been directed by DOD for military transportation, the Marine Corps has had to reconcile container transportation and handling requirements with their flexible and responsive logistics system. This underlying objective shapes Marine Corps containerization programs and policies.

Although the Marine Corps relies on the Navy for some of its lift, other materiel must be transported by commercial vessels. Therefore, the Marine Corps had to adapt its breakbulk-based logistics system to one using ISO containers.

The Commandant of the Marine Corps directed that a study be conducted to address this change. The final product entitled, Study on Containerization Requirements for the Fleet Marine Force (1973-1982), conducted at the Marine Corps' Development and Education Command (MCDEC) Development Center in 1974, provides the basis for the Marine Corp's container concept implemented with its current Field Logistics System (FLS).

The study had three objectives: first, to assess the commercial container and container-related systems and identify how they could be effectively used in Marine Corps modes of operation; second, to identify Marine Corps MHE/CHE requirements to effectively use containers; third, develop a plan for

implementing and integrating containers and container support systems into the Marine Corps' supply distribution system.

The third study objective, formulation of a program plan to implement and integrate containers into the Marine Corps logistics system, was not completed. The recommendations addressed the first two objectives:

1. That the Marine Corps establish a container system acquisition point of contact to manage all Marine Corps matters relating to containerization and to coordinate with the DOD Project Manager for Containerization;
2. That the container system adopted by the Marine Corps be developed around a modular system of small PALCONs and intermediate-sized QUADCON containers;
3. That a series of ISO MHE/CHE and transportation equipment be developed, including equipment in support of an over-the-shore operations. A systems approach was recommended for assessing requirements for POE to employment;
4. That the Marine Corps support and participate in the efforts of the DOD Container Project Manager to ensure Marine Corps compatibility with other DOD container systems and with the trends of the commercial container shipping industry.

In addition to these four programmatic recommendations, a series of more specialized actions were proposed, e.g., heavy lift capability for helicopters, horizontal movement capability for containers aboard amphibious vessels, over-the-shore systems.

In a joint effort beginning in 1976, the Marine Corps and the Navy developed the Amphibious Logistics Support Ashore (ALSA) concept. ALSA was to provide for containership support of the Assault Follow-on Echelon (AFOE) to compensate for the decreased availability of amphibious vessels and commercial breakbulk ships.

The ALSA concept includes two systems. The first is the Navy's Amphibious Logistics System, including amphibious craft, lighterage and support elements. The second system is the Marine Corps Field Logistics System which was

undergoing development and refinement at the time. These two systems were integrated into one program to be managed by Headquarters, Marine Corps, as the Field Logistics System (FLS).

Consequently, the FLS became an integrated logistics system, focused around the use of the ISO container to exploit all modes of transportation, that included life cycle management and combat requirements. The objectives were to reduce labor, reduce equipment acquisition and logistics support costs while maintaining combat readiness and flexibility.

6.2 The Modular Container Concept

Container-related reports since the initial requirements study have largely focused on specialized functions and hardware tests and evaluations, e.g., development and test of lighterage, CHE/MHE. The integration of these elements provided the basis for the current FLS General Supply category which encompasses ISO modular container system.

The FLS General Supply category was described in a 1980 report by Northrop Services entitled, Master Implementation Plan for the Marine Corps Field Logistics System. This detailed study described each element of the FLS and its relationship to other components within the total Marine Corps logistics system. The primary discussion relating to ISO containers referred to the modularization concept designed to manage container handling/transportation requirements while meeting the Marine Corps' need for flexibility. As described by the Implementation Plan, the Marine Corps FLS General Supply category is comprised of small, intermediate, and standard containers (including tactical shelters), with supporting hardware systems including an assortment of inserts, small item lockers, ISO frames, CHE/MHE, intra-terminal equipment, and flatracks.

Due to the size limitations of older but still active amphibious craft used by the Navy and Marine Corps, the standard container cannot be fully utilized, whereas the QUADCON, with its shorter height, can be used. The QUADCON is 6'10"H x 4'9.5"L x 8'W and when configured in a group of four can be transported and handled as a standard 20-foot container. Although only 522

QUADCONs were bought between 1984-1988, 6,300 are scheduled for procurement for general purpose in 1989-1992. As new amphibious craft are deployed which are capable of transporting the larger ISO containers, an additional 8,300 QUADCONs measuring 8' in height are scheduled for procurement during 1993-1998.

The Pallet Container (PALCON) is 41"H x 40"W x 48"L. Configured in groups of eight, PALCONs can be transported and handled by FLS assets. The PALCON provides flexibility for unitized or individual container cargo movement. The Marine Corps purchased 1,150 PALCONs in 1986. Procurement of 17,300 PALCONs began in 1988. An additional 22,200 measuring 48"H are scheduled for procurement during 1993-1998. The insert container (INSERT) is 10"H x 17"W x 45"L. The INSERT can be used individually or within the PALCON and QUADCON Rack. When configured with the PALCON Rack, the PALCON carries six INSERTS. When configured with the QUADCON, the QUADCON carries 36 INSERTS. The INSERT provides man-portable, unitized, dry cargo containerization. The Marine Corps has procured 2,040 INSERTs to date and plans to procure 125,200 more between 1989 and 1998.

A product improvement effort will begin in FY 1989 to increase the height of the PALCON by 7", the QUADCON by 14", and the INSERT by 1". A Small Items Storage Locker (SISL) for mounting inside the QUADCON will be procured in FY 1989. The effort will also develop horizontal and vertical dividers for use inside the PALCON and QUADCON to create an shelf and bin configuration.

Standard ISO containers are used for both transporting and storage. Headquarters Marine Corps expects a greater number of standard containers to be required in the future for increased warehousing functions. In addition to the containers, the FLS includes a set of ISO frames used to transport water and fuel modules which are usually preloaded on FLS M813 or M923 series Marine Corps 5-ton trucks.

6.3 Tactical Shelters

The Marine Corps is a primary DOD user of ISO tactical shelters. According to MTMC's Joint Container Control Office, the Marine Corps owns nearly 2,000 shelters as of March 1988. During research for the study, Estimate of Wartime

Container Movement Requirements in the Year 2000, TSC identified 3,243 shelters planned for Marine Corps acquisition by 1992.

The 8'x 8'x 20' "knockdown" is the primary container of the Marine Corps Expeditionary Shelter System (MCESS). Each shelter collapses into a flat unit, four of which stacked can be stowed in one 8'x 8'x 20' container cell. These are used for a wide variety of functions including classrooms, barracks, etc.

The MCESS also maintains numerous rigid shelters measuring 8'x 8'x 20' and 8'x 8'x 10' with one collapsible side for easy modularization. Another set of 8'x 8'x 20' and 8'x 8'x 10' without a collapsible side are used for Electro Magnetic Interference (EMI), TEMPEST, reverse osmosis units and other facilities.

The largest user of shelters in the Marine Corps is Marine Corps Aviation, supported by NAVAIR. The Navy's and Marine Corps' Mobile Facilities System (MFS) is comprised of 8'x 8'x 20' rigid wall containers with customized interiors and five structured hulls capable of approximately 280 internal configurations. The MFS shelter system is used for an array of avionics support functions including spares storage, maintenance, and machine shops.

Future Marine Corps procurements of ISO containers are oriented toward the acquisition of shelters. In fact more than 50 percent of future procurement expenditures for containers will go towards the purchase of MCESS shelters.

6.4 Container Policy

The FLS provides an integrated logistics concept around the use of ISO containers. In addition to the FLS, the Marine Corps is developing written policy and doctrine to guide the optimal use of containers in wartime in support of the Marine Corps Capabilities Plan goal of 70 percent containerization of Assault Follow-On Echelon (AFOE) UE and supplies, excluding POL and water, by 1992. Three efforts are of note.

First, the Marine Corps Planner's Handbook for Containers is under review at this time. The Handbook will provide policy pertaining to the purchase, lease

and use of containers by the Marine Corps. Publication is expected in late 1988, issued as a Marine Corps Order.

Second, the Marine Corps Combat Development Command (MCCDC), in conjunction with CINCLANT, is drafting TACMEMO P2005700-1-88, Deployment of the Assault Follow-on Echelon. The AFOE contains the largest amount of Marine Corps dry cargo. Therefore, it is the most amenable to containerization. The document will be the most detailed description of doctrine in an amphibious operation for the AFOE. The TACMEMO will describe the concept of AFOE deployment, marshalling, embarkation, and movement of cargo. In addition, the document will include ten specialized annexes. Annex D addresses the arrival, management and onward movement of ISO containers in the Amphibious Objective Area (AOA).

Numerous exercises and studies have identified areas for doctrinal refinements in LOTS operations and in the general movement of AFOE dry cargo. Consequently, the Marine Corps participated in joint Service efforts to develop container doctrine for over the shore movements. With the Army and the Navy, the Marine Corps has participated in the development of Naval Warfare Publication 81 (NWP 81), Joint Logistics Over the Shore. (NWP 81 will augment the NWP 22 series of documents which detail amphibious operations). Currently in draft, NWP 81 sets forth doctrine for conducting LOTS operations and the accommodation and management of containers in this environment.

6.5 Containerization in the Amphibious Objective Area

Although there are wartime scenarios where the Marine Corps would be deployed through developed ports, thereby eliminating many of the constraints on throughput, a likely scenario is the deployment of Marine Corps forces over undeveloped shore. Consequently, the Marine Corps use of containers in an amphibious scenario in a underdeveloped port raises many of the same issues that arise in a LOTS operation, described in detail in Section 8.0. Generally, limits on the optimal use of containers in a LOTS operation result from the environmental conditions of an over-the-shore operation and equipment availability.

The Marine Corps concept of deployment and assault in an amphibious operation involves three distinct parts. First, the Assault Echelon (AE), with assault troops, vehicles, aircraft, equipment and supplies initiates the assault landing. The second is the assault follow-on echelon, AFOE, with assault troops, equipment and supplies required to support and sustain the assault (normally in the objective area no later than five days after the commencement of the assault landing). Last, follow-up shipping, not originally part of the amphibious task force, delivers troops and equipment to the objective area after the assault phase has begun.

Containerization of the AE is extremely limited. The majority of materiel for any amphibious operation is limited to standard pallet loads and PALCONs. This materiel is generally pre-loaded on vehicles or in the stowage spaces of amphibious ships.

In contrast to the AE, the Assault Follow-On Echelon will be heavily dependent upon containers. As stated above, the Marine Corps has set a goal of 70 percent containerization of all AFOE dry cargo by 1992 utilizing the current FLS. It is currently estimated that approximately 30-40 percent of AFOE general cargo and ammunition can be handled in containers. The number of containers required to support the AFOE varies widely depending upon numerous planning considerations and stow factors dictated by specific OPLANs. Generally, however, 7,800 TEUs is considered the average number for planning considerations.

As noted above, TACMEMO PZ005700-1-88, Deployment of the Assault Follow-On Echelon (AFOE) is currently being drafted will provide detailed policy for deploying the AFOE. In addition, the document will assign responsibilities for deployment support in amphibious operations and marshalling, embarkation, and overall movement of AFOE assets, including containers.

The Marine Corps FLS is designed to provide the flexibility required to support a combat unit. The FLS uses the modular container system, enabling combat support units to carry a variety of sizes of containers from the combat service support area (CSSA) as far forward as practicable. However, MHE/CHE and

intra-terminal vehicles must be available in sufficient numbers to meet the container throughput requirement.

In addition to equipment availability, training of combat service support personnel to support container operations is critical to the operation. Currently much of the doctrine emphasized by the Marine Corps is a result of JLOTS exercises and joint service field manuals. Training and doctrine refinements resulting from these exercises are being conducted at MCDEC and Camp Pendleton. However, the over-the-shore exercises have not fully tested the Marine Corps' capability. Also, interviews elicited opinions that the RTCH, the primary CHE being procured by the Marine Corps, has not been available long enough or in adequate numbers to provide ample training time for support personnel.

The Marine Corps Containerized Ammunition Study 1985-1995 and interviewees for this study identified the concern that there may not be enough CHE on the beach and in the marshalling area to support both containerized ammunition and resupply movements. This potential shortfall could be a critical factor in moving and marshalling as many as 300 containers a day for a Marine amphibious operation. Currently, the Marine Corps plans to procure CHE to ensure that adequate equipment is available to move and marshall this planned throughput.

As discussed in Section 8.0 of this study, there have been a number of Army container management systems developed with varying degrees of success in past exercises. However, interviews indicate that the Marine Corps believes that container tracking requirements are beyond the capability of current systems. In response, NAVSEA is developing a Container Management System (CMS)/Terminal Operation Management System (TOMS).

CMS/TOMS will provide "in-transit" visibility of containers and their contents by national stock number (NSN). TOMS will manage ship and terminal operations, including Joint Task Force (JTF) operations, and all seabased support including lighterage, tugs, T-ACS, etc. Until CMS/TOMS has been fully tested in an exercise, the current policy, as outlined in the draft AFOE TACMEMO, is to utilize the Logistics Applications of Automated Marking and Reading Symbols (LOGMARS) system.

6.6 Containerized Ammunition

Marine Corps container guidance does not specifically address ammunition. In 1975, the Army was designated lead service for developing a containerized ammunition concept and the single manager for common user ammunition. Marine ammunition containerization efforts have, generally, paralleled Army and Navy efforts. The management and procurement of Marine Corps-specific ammunition is the responsibility of NAVSEA.

The current concept for utilizing containers for ammunition transport and distribution is based upon the findings and recommendations of the Marine Corps Containerized Ammunition Study 1985-1995 conducted by Systems Planning Corporation. The primary purpose of this study was to address the movement and distribution of containerized ammunition from the beach to the end user. Conceptually, the study recommended the development of a series of retail points of distribution to support combat units throughout the AOA. Each retail point would be provided with dedicated CHE/MHE to handle and strip containers. After the ammunition is stripped from the container, it is delivered to the end user in breakbulk. The study assumed that the FLS/MCCS could accommodate this distribution plan that affords the tactical flexibility lacking with a single distribution point.

However, the study states that there could be a shortage of the necessary CHE/MHE, particularly the RTCH. The study further cites that the planned number of RTCHs to handle containerized ammunition requirements is likely to equal the total number planned for an entire Marine Expeditionary Force deployment.

The shortage of the RTCH on the beach is the most critical deficiency identified in the study. Consequently, recommendations for alleviating the shortfall received considerable attention in the study's recommendations:

1. Determine requirements for the RTCH to handle other than Class V,

2. Determine whether alternative equipment (flatracks, forklifts, self-loading container handlers) would reduce RTCH requirements,
3. Acquire and field the required CHE.

The Marine Corps is procuring RTCHs based upon funding availability. By the end of 1988, 98 more should be fielded, with 35 additional units planned for 1989. The Marine Corps is also planning to purchase a new piece of equipment, the Container Handler All-Purpose (CHAP), which is now in the prototype stage of development. The CHAP is expected to provide greater operational flexibility than the RTCH.

For containerized ammunition, the Marine Corps has relied generally on the Army as the designated lead Service for containerized ammunition hardware development and testing. Marine Corps doctrine in the area of handling and stripping ammunition containers uses Army developed doctrine outlined in Army Field Manuals including, FM 9-6 Ammunition Service in the Theater of Operation and FM 9-38 Conventional Ammunition Unit Operations.

6.7 Summary Observations/Issues

1. The Marine Corps has a comprehensive FLS container concept encompassing containers and support elements to meet both the Marine Corps' need for combat flexibility and the requirement for a responsive, efficient container-oriented distribution system.
2. The Marine Corps Capabilities Plan has set a goal for the AFOE to be 70 percent containerized (UE excluding square loaded items, and accompanying supplies excluding bulk POL and water) by 1992. It is generally accepted that the Marine Corps can currently handle approximately 30-40 percent of its AFOE materiel in containers. The Marine Corps is acquiring large numbers of small containers (PALCON, QUADCON, HALFCON) that when hooked together form an 8' x 8' x 20' unit capable of being secured in the cell of a containership. Further policy definition will come from the following documents being developed: The Marine Corps Planner's Handbook for Containers, Assault Follow-On Echelon Operations (FMFRP 7-8), and JCS Pub 4-03 Joint Logistics Over-the-Shore. In

addition, the formation of the Marine Corps Research and Development and Acquisition Command (MCRDAC) promises to augment Headquarters Marine Corps containerization initiatives with the further development of container related systems.

3. Marine Corps initiatives in containerized ammunition have paralleled Army developments. The newly formed MCRDAC will to coordinate these efforts which have generally pertained to bracing and restraint systems. Doctrine will continue to be developed by the Combat Development Command.

4. The availability of CHE, particularly the RTCH, remains a critical constraint on the Marine Corps' use of containers. Assuming 100 percent equipment reliability, the total handling requirement for containerized munitions alone may require the total RTCH allotment for the AFOE. Similarly, the limited available number of RTCHs has restricted the amount of training that can be conducted in peacetime. However, the Marine Corps plans to purchase additional RTCHs and plans to field the CHAP in 1993 which will augment capabilities.

5. Given the probability of the Marine Corps being deployed on an undeveloped shore in wartime, the container issues identified and described Section 8.0, Logistics Over the Shore Operations, should be regarded as issues directly affecting the Marine Corps.

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7.0 AIR FORCE CONTAINERIZATION

This section addresses Air Force activities in implementing containerization into its supply and deployment systems. Details of developing the air movement subsystem, which has presented difficult intermodal problems, are presented.

7.1 Integration of Containers into the Airlift System

In 1957, commercial steamship lines began using containers that moved easily between modes of transportation, resulting in the ANSI/ISO international standardization prevalent today. In that same year, the Air Force began developing the concepts for the 463L system, the basis for today's Air Force air cargo handling system.

The 463L system consists of three main parts: a 108"x88" pallet, a built-in internal restraint system and ground handling equipment (forklifts and flat bed loaders). The aircraft system has roller conveyors, guide and locking rails, and tie-down rings. The system was designed to serve aerial port to aerial port movements, rather than through-intermodal movements from source to user, as facilitated by standard containers. The interface between 463L pallet and standard land/sea containers, which do not have a flat bottom, has also caused difficulties, and the nine-foot wide pallet is not dimensionally compatible with the eight-foot wide container and the container handling and transport equipment. In addition to container handling difficulties, the tare weight of the container can, in some cases, reduce cargo carrying capacity.

Air Force efforts have focused upon incorporating the container while maintaining the 463L system. But, the incompatibilities have caused problems for integrating commercial containers into the airlift system and for completing a fully intermodal DOD system.

In 1971, the Air Force-led Land-Air-Land task group was established to address the integration of standard intermodal containers into the airlift system. As noted in section 3.0, the working group was an integral part of developing a container-supported logistics system. However, the efficiency of the 463L system and the low volumes of air cargo generated within time-frames to fill

containers on a source-to-user basis caused doubts about the utility of standard containers in the air system. However, the Air Force recognized that changing logistics concepts and specialized Service requirements e.g., the Army's planning for extensive use of containers from source to user, as defined in the Army in the Field Container System Study, would cause increasing numbers of intermodal container movements. An Air Force study completed in 1972, Impact of Intermodal Containers on Air Force Cargo Airlift, documented the problems of integrating containers into the airlift system.

In a 1973 Air Force Air Cargo Container Policy, the Air Force said it would accept any containers for airlift within its capability to handle, with weight, cube and design of the container as limiting factors. A 1974 study, Aerial Port Container Handling Equipment Requirements and Air Transportability of Intermodal Containers, categorized aerial base operations to determine equipment types and quantities that would be required for the 1975-1980 time-frame. Major and minor container handling bases were identified as were functional requirements for container airlift operation. The study cited container handling equipment requirements, by type of port, for 1980, but not requirements for MHE to stuff and unstuff containers. A five percent level of containerization for air transport in 1980 was assumed. By 1975, the Air Force had also indicated that because container shipments were considered source-to-user movements, stuffing and unstuffing should not occur at the aerial port and that the shipper rather than MAC should obtain the containers.

As the Executive Service for the Land-Air-Land group, the Air Force published a Joint Service Project Development Plan in 1972. Objectives included:

1. Certifying the air transportability of MILVANS,
2. Testing modular containers,
3. Developing an adapter pallet to interface between the container and the cargo restraint system,

4. Developing a program to acquire aerial port container handling equipment to support the projected airlift requirements,

5. Determining the optimal size container for use in the air system.

Preceding the phase-out of the DOD Project Manager for a Surface Container Oriented Distribution System in 1975, the Air Force stressed the need for centralized management of the system development. The air distribution of containers represented the most difficult intermodal challenge, and the Air Force recognized that a centralized effort would support the definition of its air container movement responsibilities. Because the Air Force provides common user strategic airlift through the Military Airlift Command, Service logistics concepts, particularly those of the Army (the largest shipper by sea and air), impacts the Air Force's air cargo handling requirement. Consequently, the Air Force was a proponent for centralized Army-led management, rather than a decentralized approach, to address container distribution for land, sea and air.

Although the centralized DOD-wide approach was not adopted for the post-1975 period, the Joint Service Land-Air-Land Container Systems Development Task Group was rechartered under the guidance of the Joint Container Steering Group. The mission was to coordinate the development of standard equipment, policies and procedures to be used by the Services and Defense Logistics Agency to ensure that compatibility between the surface and air systems.

The Air Force also established an ad hoc group whose purpose was to address all aspects of Air Force containerization through one coordinated effort. The Air Force Containerization System Development Group (AFCSDG) was chartered (AFR 75-26) under the direction of the Air Staff in 1975. To ensure interface with other Services, the Air Force group disseminated information through the Joint Service DOD Land-Air-Land Task Group. The AFCSDG also began to provide inputs to the Air Movement Plan, the Air Force responsibility for the Program Master Plan. With the full decentralization of container efforts in the early 1980s, the AFCSDG became the focal point for coordinating all Air Force container programs. (Note: the name of the group changed to the Air Force Intermodal

Systems Development Group (AFISDG) in 1986).

The AFCSDG addressed three critical areas: (1) airlift of containers, (2) munitions containerization, and (3) containerization of surface cargo. Requirements for an adapter pallet for use with the 463L system, for container handling equipment and for a light-weight air container were included. For munitions, the early concern centered around appropriate container characteristics, handling equipment and extent of container use.

The Air Movement Plans have been the Air Force input to the DOD Master Plan since the dissolution of the Land-Air-Land Task Group. The 1984 version of the Air Movement Plan is currently in effect, to be replaced by a new version currently in draft form. The Plan sets guidelines and milestones for a coordinated approach to the airlift of containers through the simultaneous development of container, air terminal and aircraft subsystems in conjunction with air movement requirements. The Plan states the criticality of the requirements information, namely that the completion of the Air Movement program is dependent upon the development of air movement requirements for containers and tactical shelters.

7.1.1 Air Movement Requirements

By 1974, the Air Force had surveyed its air bases for container handling equipment and categorized them based upon expected container throughput. Container handling equipment requirements were specified with long-range acquisition goals based upon the aerial port categories. In 1979, AFCSDG conducted a market research study to determine the air movement requirements of seven MAJCOMs and six DOD activities (including the other Services) for ISO containers. The parameters of the study were:

1. Only air eligible cargo should be considered,
2. MILVANs and intermodal containers w e eligible for airlift,

3. Stuffing and unstuffing should be at locations other than APOEs and APODs,
4. Two days may be taken for consolidating cargo, and
5. Requirements were to be stated for peacetime and wartime, including tonnages by month and number of 8'x8'x20' containers.

For wartime, only the Air Force identified any container airlift requirement. Tactical shelters were not included, but the Air Force was attempting to estimate this wartime lift requirement, which was becoming important following increased development and procurement. ISO tactical shelters are containers having live- and work-in capabilities rather than serving pure transportation functions. They do, however, pose the same shipping and handling requirements as containers of cargo for the airlift system. Even if the Services plan no cargo containerization for airlift, the shelters, which are considered unit equipment, impose a minimum container lift requirement, which has been difficult to precisely quantify.

In conjunction with the development of the C-17 airlifter, the Office of the Assistant Secretary of Defense (A&L) tasked the Transportation Systems Center to estimate wartime container movement requirements. The estimate was keyed to the Defense Guidance (1992) deployment scenario. This effort, published in 1986 (Wartime Air Container Movement Requirements in the Year 2000), focused upon both service policies regarding containerization of cargo and the allocation of tactical shelters to units scheduled in the scenario for airlift in the first 60 days. A PC-based model was developed in conjunction with this study which permits sensitivity analysis around key variables--theater, service, cargo class, and container size.

Service responses to a questionnaire about air containerization policy for unit equipment, ammunition and general resupply showed low expected container usage rates for all Services (no more than five percent for unit equipment and no more than ten percent for any class of supplies). However, allocation of tactical shelters showed nearly 2,710 that would require airlift for Army and Air Force units and an additional 2,790 containers being procured by the Army Surgeon General for use by airlifted hospital units.

The study demonstrated the considerable impact of tactical shelters and containers considered part of a unit's equipment on the container airlift requirement, even in the absence of a lift requirement based upon Service policy on containerization for airlift. Careful tracking of the number and allocation of shelter and container procurements is required to ensure an estimate of the minimum lift requirement. Without such an estimate, MAC cannot accurately plan for either the characteristics of its movement requirement or for handling capability at its aerial ports.

7.1.2 Exercising the Container Air Movement System

In 1977, MAC proposed testing cargo handling equipment in conjunction with ALOC shipments from New Cumberland Army Depot to Germany (see Section 4.4 for details of the test). The test was conducted in conjunction with DARCOM in 1981-1982 using light-weight air/land intermodal containers. Following the test, the Air Force obtained permission from DOD to purchase 50 containers to implement peacetime Army ALOC movements. The Army had identified a 45 per month container requirement for these shipments. However, neither the purchase nor the regular container movements occurred.

In 1984, the Air Force Logistics Management Center investigated whether any locations within the Air Force and/or other DOD elements generated enough cargo to justify the use of containers for air movements (Application of Air Containerization). A methodology was developed using a database of Transportation Control and Movement Documents (TCMDs) to identify containerizable cargo and the container requirement was estimated. The threshold for justifying container use was generation of enough cargo to stuff fifteen containers per month or 130 per year. Inbound and outbound shipments were considered. A shipper would have to fill one container every two days to meet Uniform Materiel Movement and Issue Priority System (UMMIPS) time standards for hold times; no shipper approached that figure.

Although MAC recommended that containerized air movements begin in order to exercise the system to prepare for wartime requirements, finding a peacetime source of air eligible shipments has been problematic. Currently regular

peacetime shipments of containerized cargo are not made in the MAC airlift system.

7.2 Ammunition Containerization

Joint Service efforts to apply containerization to the movement of munitions was detailed in the Program Management Plan for Containerized Ammunition Distribution System CADS Development (Conventional Munitions) in 1978 and in the 1983 revision. This document, with the Army as the lead service under the JCSG, assigned responsibilities to each Service and provided guidance to ensure the integration of separate Service development responsibilities. The AFCSDG has coordinated Air Force activities and input to the Army-led Containerized Ammunition Distribution System effort since 1978.

The CADS responsibilities outlined for the Air Force stressed the integration of container movements into the airlift system as part the larger container-oriented distribution system development. The 1978 plan called for a verification of the previous (1974) aerial port handling capability estimates (cranes, MHE, docks and marshalling areas), and a determination of container equipment handling requirements. The latter estimate posed the same difficulty as determining the general wartime airlift requirement, namely that air movement requirements were not forthcoming, thereby impeding equipment requirements definition. By 1982, after the further decentralization of container development management to the Services, the Air Force incorporated all efforts related to the air movement of munitions to the Air Movement Plan. The 1983 CADS Plan continued similar efforts.

The Air Force has also pursued container use for its surface moves of ammunition, however. Unlike the Army which developed concepts and doctrine for the containerized distribution of ammunition centrally, the Air Staff through the AFCSDG had requested that each MAJCOM develop concepts of operation for containerized munitions. Inter- and intra-theater policies and movement patterns had to be established and host nation support requirements identified. By 1978, the Strategic Airlift Command and PACAF had identified a wartime need for commercial, drop-side, open-top and half-high containers.

Air Force efforts pertinent to the operational aspects of containerizing ammunition have paralleled those of the Army. Namely, criteria for the use of commercial containers imposed by the Coast Guard (CG) and the Association of American Railroads (AAR) applied to Air Force shipments as well. Also, the Army, as Single Manager for Conventional Ammunition, provided outload drawings for all Army-managed Air Force munitions. The Air Force retained responsibility for developing blocking and bracing drawings for commercial containers to carry non-single-managed items. By 1980, criteria for selection of closed commercial containers had been approved by the CG and the AAR but the use of other-than-enclosed containers, e.g., open tops and flatracks, required test and evaluation by the U.S. Army Defense Ammunition Center and School. The Air Force, at its 1980 AFCSDG meeting decided that it was ready to implement procedures for surface movements of munitions by commercial container. Activities continued to determine requirements for handling equipment, availability of specialized containers, munitions distribution patterns and containerized munitions air movement requirements.

The Air Force saw a need to exercise the use of containers for ammunition in peacetime to prepare for wartime conditions and to expand to the use of commercial containers. A series of validation tests were conducted with shipments to USAFE and PACAF between 1973 and 1985 to identify handling and internal restraint problems. The first eight tests used MILVANS, but the final three used standard commercial containers and flatracks. Although flatracks are in short supply in commercial inventories, general purpose MHE available in the theaters could accomplish the unstuffing.

The Air Force also investigated the use of side-opening containers for both storage and transportation. After testing and approval of blocking and bracing designs, the Air Force has plans to procure approximately 1,200 side-openers, of which over 300 have already been delivered. Due to host nation restrictions in theater, however, the side-opening containers will be used for storage only. Several of the Air Force containers were used in the most recent test (conducted by the Army's Project Manager for Ammunition Logistics) of commercial container shipments to Germany in November 1987.

7.3 Resupply Containerization

The Air Force Logistics Command (AFLC) undertook a study in 1977 fostered by a concern about the increasing transit times for Air Force cargo that was consolidated with that of the other Services and containerized at seaports. AFLC was studying four alternatives:

1. Improve present loading at Army ports,
2. Containerize at an Air Force activity,
3. Containerize at the three Army container loading facilities (Sharp, Red River, New Cumberland),
4. Contract for a commercial carrier to operate a single, centralized stuffing facility.

Following from the study, two container consolidation points (CCPs) were established at Warner-Robins AFB, GA, and at McClellan AFB, CA, to process Air Force less-than-full containerload cargo into full container shipments. The Air Force War Mobilization Plan for FY 87-88 indicates that these two CCPs will serve this function for wartime surface shipments as well.

7.4 Unit Deployment by Surface

To date, the Air Force has focused primarily upon integrating containers into the airlift system and upon containerizing munitions. Some Air Force units may be scheduled for surface deployment, and the possibility exists for changing priorities which would cause an airlift-scheduled unit to move by surface instead. Therefore, planning for these movements should occur.

At the 1986 AFISDG meeting, the issue of containerized unit outload for surface deployment was addressed, due to problems with handling containers and the availability of CHE during an August 1985 exercise. Three alternatives for unit equipment container stuffing were discussed: (1) using the two existing Air Force CCPs, (2) using CCPs set up by MAJCOMs and (3) using the home unit to

containerize at outload installations. The Air Staff indicated that the preferred alternative was installation stuffing and recommended that units designated for sealift develop full-container capability and that MAJCOMs develop training programs to this end. This would enhance efficient outloading for units diverted to surface from airlift as well.

To date, plans have not been formulated for implementing containerized outload for surface-deployed units. The Air Staff has, however, issued a memorandum to the effect that units should plan to containerize in full loads at home stations.

7.5 Container Management

The Air Force Cargo Movement Operations System (CMOS) is currently under development with initial operating capability for five bases scheduled for December 1989. The goal of the system is to provide source-to-user visibility of containers and container contents. The Functional Description for CMOS was made available to TSC during this study.

Currently, limited in-transit data, advance transportation and movement capability and a daily/weekly shipping list is automated in a batch system. However, scheduling, receipt, packing, document preparation, shipment processing and cargo tracing are performed manually.

CMOS will provide an automated capability for performing these processes and for tracing shipments from origin to destination in a timely manner. Data input will be made to terminals by users and through hand-held terminals with laser scanners. In addition to automating documentation and to providing management information, the pallet (for air shipments) as well as the cargo it carries will be recorded. CMOS is intended to provide analogous information for a containerized system as for a pallet-oriented one.

7.6 Summary Observations/Issues

1. Air Force container system development has been centrally managed since the 1971 establishment of the Land-Air-Land Task Group, established to address the integration of ISO containers into the airlift system.
2. After 1975, the AFCSDG coordinated Air Force surface container issues and by the early 1980s was the focal point for its air movement initiatives as well. The AFISDG continues to serve this function under the direction of the Air Staff. Generally, however, the Air Force has not developed extensive doctrine, but has relied on the MAJCOMs to determine individual concepts of operation.
3. Integration of containers into the air movement system continues to pose intermodal challenges. The lack of specific container and shelter air movement requirements for all Services has hindered planning for expected aerial port throughput. Identification and continual tracking of tactical shelters is especially important because, even in the absence of policies to containerize cargo, the shelters represent a minimum airlift requirement. Requirements estimates, particularly from the Army, necessitates on-going inter-Service coordination.
4. Using containers in the air movement system has not been exercised as preparation and training for wartime. Therefore, experience in handling has not developed and constraints and bottlenecks have not been fully identified.
5. Air Force efforts in the area of containerized munitions have paralleled those of the Army. Restraint systems for different container types have been developed and movement tests have been conducted. However, commercial containers, planned for use to augment organic fleets, have not been used for regular peacetime surface shipments.
6. Planning for Air Force units to containerize for deployment by surface has not occurred. Sizing unit equipment for containers and developing requirements estimates must occur. Base physical characteristics, equipment and personnel

capabilities must be examined to determine the current level of readiness, shortfalls and preparation for resolving the shortfalls.

8.0 LOGISTICS OVER THE SHORE OPERATIONS

This section provides background on Logistics Over the Shore (LOTS) concept and describes those aspects and supporting systems of a LOTS operation impacted by the use of containers. The LOTS concept encompasses discharging cargo from ships in the stream and transporting that cargo across the beach. LOTS operations are introduced when fixed port facilities are not available because they are undeveloped, inadequate (e.g., shallow draft ports), or damaged. A LOTS operation is usually conducted following an amphibious assault operation when the beach has been secured, or as a separate operation with no prior amphibious assault. Therefore, the success of a LOTS operation has the greatest impact on the Marine Corps Assault Follow-On Echelon (AFOE) and continued sustainment.

Traditionally, military planning has emphasized a NATO-Warsaw Pact scenario where developed ports and host nation support are assumed to be in place and available. However, military experiences of World War II, Korea, and Vietnam have highlighted the requirement for a LOTS capability to conduct military operations in often remote undeveloped regions or where port facilities may be damaged or not available.

8.1 Off-Shore Discharge of Containerships (OSDOC)

The Joint Logistics Review Board, recognizing the trend toward increased containerization, recommended that the capability to discharge container ships in damaged or undeveloped ports be established. As a result, the Over the Shore Discharge of Containership (OSDOC) concept was developed under the direction of the Army. Subsequently, a Joint Service test of the concept, known as OSDOC I, was conducted at Fort Story, Virginia, in 1970. Utilizing a self-sustaining containership with an on-board gantry crane and heavy lift helicopters, OSDOC I was the first test of a system designed to discharge containers over the shore.

The Army's and Navy's primary objective was to establish the adequacy of the Services' baseline capability to discharge containers over the shore using available CHE/MHE, doctrine, training, and air and surface lighterage systems.

The OSDOC I test utilized a systems evaluation for its testing framework, i.e., it assessed each operational subsystem's performance and impact on other subsystems.

The findings of OSDOC I, as detailed in the 1970 Over the Shore Discharge of Containership After Action Report by the Army Transportation Center, confirmed the limits that the natural environment places on the efficiency of a LOTS operation. Earlier, the Army's Trans Hydro Craft Study, 1975-1985, and the Navy's Terminal Logistics Workshop and Integrated Sealift Studies identified wind, sea, and terrain conditions as the primary factors inhibiting amphibious operations. Although these limiting factors were already known, OSDOC I provided empirical data with which future planning factors and operational refinements were made. However, the test's greater contribution was its list of recommendations that initiated the development of specialized CHE/MHE, training, and doctrine and other hardware systems designed to optimize container throughput in an over-the-shore operation.

In 1972, the DOD Container Project Manager's Master Plan defined the requirement for continued tests to ensure the Services' capability to conduct over the shore operations. The Project Manager designated the Army and Navy to conduct an operational test of the Services' capability. Entitled OSDOC II, the primary objectives of the test were to assess the Services' progress since OSDOC I and to assess their capability to discharge containers from both self-sustaining and non-self-sustaining container vessels. OSDOC II, more than previous tests or studies, identified environmental constraints on container throughput as the primary conditions to overcome, and focused on development and refinement of supporting hardware systems, doctrine, and training to this end.

As noted in Section 3.0, the lack of a developed over-the-shore capability was a major factor in the extension of the DOD Container System Project Manager's charter. The Project Manager supported by a system definition paper issued from OASD (I&L) entitled "Over the Shore Discharge Cargo System" assigned system development responsibilities to the Services to overcome constraints in these operations. Following the disestablishment of the Project Manager's Office in 1975, the integration and test of each of the Services' initiatives

were coordinated by the Army's Joint Logistics Over The Shore Test and Evaluation Program.

8.2 Joint Logistics Over the Shore (JLOTS)

The first Joint Logistics Over The Shore (JLOTS) test was in 1977. Initiated by the Army, the test was to evaluate new systems and revised training and doctrine that had been developed since OSDOC II. The JLOTS I test plan was designed to provide an overall assessment of the Services' capability to (1) handle, transport, and assemble new container-oriented systems such as the Navy's Container Offloading and Transfer System (COTS); (2) operate the new systems in support of a non-self-sustaining containership and; (3) effectively manage beach and marshalling area procedures.

The results of JLOTS I revealed considerable shortfalls in the Services' previous container handling goals and objectives made after OSDOC II. Operationally, JLOTS exhibited the same vulnerability to environmental factors as the OSDOC operations.

In addition to the limitations of the operational environment, the handling, assembling, and operation of CHE, lighterage, and other sub-system components revealed insufficient system/equipment redundancy and capability to maintain optimal operations. The test and throughput assessment also identified the requirement for the Services to refine container handling training, container marshalling and procedural developments rectifying skill and procedural issues similar to those identified during the OSDOC II test.

The JLOTS I test and subsequent evaluation highlighted the status of the Services' capability in conducting over the shore operations since OSDOC II. In sum, the results and evaluation of the JLOTS I exercise indicated continuing problems since OSDOC II. Specifically, the operational goal of developing a JLOTS container supported distribution system, which would increase cargo handling capability (over a breakbulk system) by 250-400 percent and reduce the required number of cargo handling personnel by 25 percent, had yet to be realized.

The findings of JLOTS I resulted in the formulation of a Memorandum of Agreement (MOA) between the Army and Navy in 1982. Generally, the development of CHE/MHE and selected amphibious utility craft was assigned to the Army. The Marine Corps was responsible for the development of additional intra-terminal container-capable vehicles, and the Navy was responsible for the continued research and development of the Container Offloading and Transfer System (COTS). COTS, an element of the Navy's Amphibious Logistics System, is a program that is comprised of three sub-systems: the ship offloading system (primarily cranes and environmental controls), the ship-to-shore system comprised of an assortment of modular pontoons that can be configured with powered modules to form lighterage, and several environmental and inter-operable equipment interfaces.

Since 1982, MOA has been revised three times to reflect changes and progress made in each of the program areas. Currently, the 1986 MOA is under review for possible further revision.

8.3 Current Capabilities

The results of JLOTS II together with other recent exercises, such as BOLD EAGLE 86 and FREEDOM BANNER 86 which assessed some subsystems of a full scale LOTS operation, indicate the current LOTS operational capability. The following subsections describe the phases of a LOTS operation and the issues around throughput of containers. The current concept for moving dry containerized cargo in a LOTS operation covers four primary phases: (1) ship transfer operations, (2) ship-to-shore operations, (3) beach operations, and (4) marshalling operations.

8.3.1 Ship Transfer Operations

Ship transfer operations involve transferring of containers via crane or Ro-Ro from a ship's hold to lighterage. Transfer operations are usually the Navy's Cargo Handling Force (NCHF) responsibility following an amphibious operation. The Army's Terminal Service stevedores have the responsibility when the LOTS operation is in support of a base or part of theater development.

The primary limiting factor for any LOTS operation is its sensitivity to weather and environmental elements. The operation is most vulnerable to these factors during ship transfer, and ship-to-shore operations. Three methods used in ship transfer operation to discharge containers from a vessel are: airlift, Ro-Ro, and crane onto lighterage. Each is acutely affected by environmental factors. Airlift discharge by helicopter for instance proved to be highly dependent upon visibility and wind conditions during OSDOC tests. Discharging by Ro-Ro and crane are affected by sea conditions; operations are greatly impeded at sea state 2 and prohibitive at sea state 3. Operation of the Ro-Ro Discharge Facility (RRDF) is affected due to the pitch and roll of the ramp during high seas. Similarly, crane operation is hindered by sea and wind which cause pendulation effects. Despite COTS corrective hardware designs to compensate for the environmental effects and despite increased personnel training, optimal operation continues to be limited to winds below 30 knots, and to sea state 3 and below.

8.3.2 Ship-to-Shore Operations

Ship-to-shore operations encompass the movement of containers by lighter to the shoreline. The Navy and Marine Corps conduct this segment of a LOTS operation until the operation transitions to the Army.

As in ship transfer operations, the primary operational limitation is the environment. Quite simply, as sea conditions degrade lighterage assembly time increases and productivity decreases.

Newly developed doctrine and training coupled with refinements in some COTS subsystems have yet to be tested; their capability to compensate for environmental factors will be tested in next JLOTS exercise.

8.3.3 Beach Operations

The third segment, beach operations, includes the discharge of containers at the surf line. If transported by Ro-Ro, they are either driven or towed off the beach, or handled by Light Amphibious Container Handlers (LACH) or Rough Terrain Container Handler (RTCH). Beach operations are generally conducted by

the Marine Corps until transitioned to Army LOTS. The throughput rate of containers at this node is largely dependent upon two factors, the rate at which lighterage can be discharged and the rate at which containers can be transported off the beach to the marshalling area.

Lighterage discharge rates at the shoreline are also heavily dependent upon sea state. Although the Elevated Causeway System (ELCAS), a joint Navy and Army program, has compensated for much of the limitation imposed by the surf at the beach, the discharging of lighterage at pier side is still impeded by the same sea state limitation experienced during ship transfer operations.

The capability to clear containers from the beach to the marshalling area relies on the availability and reliability of container handling equipment. The RTCH is becoming the most widely used piece of CHE and has generally proved successful. However, because of the RTCH's operational versatility it is used aboard ship, on the beach, and in the marshalling area. Subsequently the number of available RTCHs and the trained personnel to operate and maintain them has become critical to optimal container throughput.

8.3.4 Marshalling Operations

The fourth phase, marshalling operations, consists of the unloading of containers from amphibious craft, and intra-terminal vehicles, cargo control and documentation, and preparation of containers for onward movement. The Marine Corps combat service support element is responsible for marshalling operations until the operation transitions to Army LOTS, at which time the Army's terminal transfer company personnel assume responsibility.

The two factors impacting the optimal use of containers at this stage of a LOTS operation are CHE equipment availability, and cargo control and documentation systems. The RTCH and the LACH are the most common pieces of CHE used in the marshalling area. As in beach operations, their availability and reliability is crucial to the efficient transporting and marshalling of containerized cargo. For instance, an analysis of Exercise Freedom Banner 1986 done by the Center for Naval Analysis (CNA) demonstrated the critical role of CHE/MHE in the throughput rate of containers. During that Exercise the failure of one

RTCH slowed the deployment of lighterage. Later, a second RTCH failed in the Exercise causing container operations to cease completely.

The results of these more recent exercises coupled with the past experiences of OSDOC and LOTS I have resulted in the Services' refinement and development of doctrine and procedures, detailed in NWP 81, Joint Logistics Over the Shore, (Coordinating Draft, January 1988), to respond to capability shortfalls. In addition to NWP 81, draft TACMEMO PZ005700-1-88, Deployment of the Assault Follow-On Echelon, discussed in Section 6.0 in greater detail, addresses the overall responsibilities in support of amphibious operations. While NWP 81 only addresses LOTS operations, the draft TACMEMO provides policy guidance to the total amphibious operation as it impacts the embarkation and movement of AFOE assets and containerized materiel.

8.4 Container Management in a LOTS Operation

Cargo inventory information systems were found to be of crucial importance in JLOTS exercises. For example, manual inventory control procedures were identified as key inhibiting factor to the optimal throughput of containers during JLOTS II. The Marine Automated Cargo Throughput Documentation System (MACTDS) provides container inventory data and tracking information from the POE to the retail distribution point of the landing force. The Department of the Army Standard Port System-Enhanced (DASPS-E) is the Army's counterpart of MACTDS. In addition to the Services' independent management information systems, Logistics Applications of Automated Marking and Reading Symbols (LOGMARS), applies bar code technology to track cargo eliminating timely manual documenting procedures. DASPS-E has not been fully tested during a LOTS operation; however, the MACTDS prototype was assessed during JLOTS II and was found to be reliable.

During JLOTS II, MACTDS and the Automated Cargo Documentation System (ACDS), the predecessor to the Army's current system DASPS-E, were found not to be compatible, causing loss of, or requirements to manually generate, inventory and cargo movement data. Therefore, it was recommended following JLOTS II that a MACTDS and DASPS-E interface be developed to facilitate transition to Army

LOTS. That interface capability has not been documented to date, and current doctrine indicates that each Service will use its own documentation system and upon transition shift to a single system. In addition to these existing systems, NAVSEA is developing Container Management System/Terminal Operation Management System (CMS/TOMS) which is to be tested in 1988. CMS/TOMS is discussed in greater detail in Section 6.0 of this study.

8.5 The Over-the-Horizon Concept

The present over-the-shore capability has been structured around a World War II "close in" tactic where the container ships discharge in the stream close to the shore, generally in view. The current container capable lighterage, COTS elements, personnel, doctrine and training have delivered containers with limited success, given the relatively short distance (usually a 1000 yards). However, as the President's Commission on the Merchant Marine and the National Defense has pointed out, commercial cargo vessels are in short supply. Consequently, their value as strategic assets has increased. Moreover, with the proliferation and recent successes of short range weapons, particularly in the Falklands and Persian Gulf, the vulnerability of these vessels has also increased. In addition to this vulnerability, amphibious operations require the flexibility to project forces to a wide range of objective areas while maintaining an element of tactical surprise. This tactical flexibility and the operational vulnerability has prompted discussion of the "over-the-horizon" (OTH) tactic.

The OTH tactic positions the cargo vessels and the in-stream discharge operation out of the line of sight, in an attempt to maintain a defensible distance. Although the increased distance may better protect vital maritime assets and maintain the element of tactical surprise, it also has the potential to exceed the technical and doctrinal capabilities of current lighterage, cargo transfer systems, and cargo handling personnel. Similarly, sensitivity to environmental effects may increase in an OTH operation. Although there are systems that can compensate for the increased distance with increased speed, e.g., the Landing Craft-Air Cushioned (L-CAC) capable of transporting four 20-foot containers, the potential impact on an over-the-shore operation beyond the AE posed by a potential change in tactics has yet to be thoroughly assessed

and may present several challenges to container transfer and transport over the beach.

8.6 Summary Observations/Issues

1. The capability to conduct over-the-shore operations has received considerable attention over the past 15 years but with varying degrees of priority and success. The delivery of containers in these operations continues to be hindered by the operational environment. Although numerous systems such as the ELCAS and COTS environmental control systems have been developed, sea state and wind continue to inhibit optimal container throughput. Past exercises have also identified shortfalls in the management of container movement. However, recently drafted guidance and information systems are designed to eliminate many of those previously identified management issues.
2. There has not been an exercise to test the Services' capability to transport containers in a full LOTS operation. For example, JLOTS II experienced time and environmental constraints limiting the container throughput test to the movement and retrograde of containers.
3. Past exercises have been important in the development and improvement of the Services' overall capability. Each exercise has provided considerable information identifying potential constraint points and an opportunity to refine current doctrine. For example, the number and reliability of CHE was identified as critical to container movement in Freedom Banner 1986. Past exercises, particularly JLOTS II, have enabled the Services to expand and refine current doctrine, e.g., Joint Logistics Over the Shore, NWP 81. Each exercise has provided new information on problems with over-the-shore movement of containers, resulting in efforts to improve systems and refine doctrine. Similarly, each exercise and evaluation has provided a renewed sense of momentum in development of the overall capability.
4. The use of management information systems in the AOA continues to be unresolved. Each Service is currently using its own container inventory/documentation system. For example, results from JLOTS II identified information system incompatibility as a major constraint in the management of

cargo and in the transition of JLOTS to Army LOTS. The two systems being used by the Services during JLOTS II were not compatible. Therefore, container inventory and movement data had to be documented and entered manually before full transition to Army LOTS. There is no indication in recently drafted guidance that an interface has been developed or a transition to CMS/TOMS or a similar system has been made to alleviate the problem.

5. Any changes to the over-the-shore discharge concept, such as OTH, may vastly complicate LOTS.

9.0 THE TRANSPORTATION OPERATING AGENCIES AND CONTAINERIZATION

Three Transportation Operating Agencies (TOAs)--the Military Airlift Command, the Military Traffic Management Command and the Military Sealift Command--are tasked to provide common-user transportation service to DOD. In 1987, the TOAs became components of the newly established United States Transportation Command (USTRANSCOM). USTRANSCOM will provide overall deployment and wartime coordination of the TOAs once it is fully operational. This section addresses the roles of MSC and MTMC in DOD containerization planning and initiatives. Section 7.0 describes MAC's role in integrating containers into the airlift system.

9.1 Overview

Currently, the Military Airlift Command is a major command of the Air Force and a specified command responsible to the Joint Chiefs of Staff. MAC provides inter- and intra-theater airlift for personnel and equipment and operates aerial ports.

The Military Sealift Command, under the Department of the Navy, is single manager for common-user ocean transportation for DOD. MSC provides immediate strategic ocean capability for emergencies and peacetime operations and can be augmented through the use of U.S. commercial ships. MSC also negotiates Container Agreements with commercial carriers for peacetime shipments.

The Military Traffic Management Command is a jointly staffed Army command that is single manager for military traffic management, land transportation, and common user ocean terminals in CONUS and in some overseas areas. In 1981, the Deputy Secretary of Defense also designated MTMC as single manager for intermodal containers.

USTRANSCOM was established to provide global air, sea and land transportation to meet national security needs. MAC, MTMC and MSC are the components of USTRANSCOM, with each TOA remaining a major command of its parent Service. USTRANSCOM's Concept of Operations (February 1988) outlines USCINCTrans' responsibility for the integration of wartime mobility procedures with U.S.

and allied transportation resources, including strategic mobility planning, automated data processing systems integration, and traffic management and operations. In addition, USTRANSCOM will optimize the use of transportation capability, including intermodal capability, through integration of common user (air, sea, land and containerization) transportation systems and resources. Therefore, USTRANSCOM is expected to play a role in the continued development of optimum wartime container use in the DOD distribution system.

9.2 Container Acquisition

MSC owns approximately 8,000 of the 32,000 ISO containers and tactical shelters registered as of April 1988 with the Joint Container Control Office of MTMC. (See Appendix 2 for details on the registered DOD-owned container fleet). Most are in use aboard MPS vessels.

For peacetime container shipments, MSC negotiates Container Agreements with commercial ocean carriers. MTMC receives movement requirements and forwards them to MSC for booking according to these in-place agreements. Most DOD cargo moves from origin to destination under an MSC Container Agreement. The Agreement includes terms, conditions and rates for transportation services including, among others, container spotting, line-haul, drayage, ocean shipment. Under the Container Agreement the ocean carriers provides the containers for individual shipments. DOD does not, generally, lease containers directly from container lessors.

While negotiated Container Agreements are used in peacetime, no other agreement for the emergency or wartime provision of containers by the commercial sector (carriers and/or container lessors) is in place. The establishment of a "master" or "dormant" agreement to acquire large numbers of containers under wartime conditions is required. Ideally, a written agreement with the commercial sector on the provision of containers would be developed in peacetime for invocation in wartime.

The Code of Federal Regulations (Title 46, Part 340) implements the Defense Production Act and provides for the acquisition of transportation resources in time of national emergency. DOD and the Department of Transportation have

considerable experience with voluntary agreements for the provision of assets, e.g., for aircraft (the CRAF program), ships, waterfront facilities, but the approach to container acquisition has been more ad hoc. During the course of this study, concern over the lack of such an acquisition agreement was voiced repeatedly.

In addition to ensuring the timely acquisition of the appropriate types and numbers of containers at the right locations, the development of an emergency container acquisition agreement should have other benefits. Namely, it would open a dialogue on DOD's requirements and the extent to which they can be met by the civil sector. This is especially true for special containers which may not be in abundant supply, particularly in the early days of an emergency. (Note: The TSC study, Availability of Ammunition-Serviceable Containers, estimated approximately 100,000 off-hire standard 20-foot containers in CONUS, subject to some fluctuation due to economic conditions. Also, see Section 11.0 of this study for a description of the U.S. and world inventory of containers). Potential shortfalls could be examined and DOD could begin to determine how to reconcile them. This could be especially critical if changes to Service or DOD policy call for increased containerization of unit equipment, which would require more special containers.

9.3 System Visibility and Flow Control

The requirement for an automated management system for tracking and managing the movement of containers has been identified continuously in the conceptual descriptions of the DOD container-oriented system. For example, the JLRB report specified management as one of its three major areas, and the Army in the Field Container System Study included a detailed description of a prototype system. Currently, however, no single system exists to manage container movements in the transportation system and to provide in-transit visibility of the containers or the cargo within them.

Following from the June, 1981, memorandum from the Deputy Secretary of Defense designating MTMC as the single manager for intermodal containers, a Joint Army/Navy Plan described the transfer of container-related functions from MSC to MTMC. These included:

1. In coordination with the overseas theater commander, MTMC is responsible for origin-to-destination management of container shipments, control of containers moving in common-user transportation service world-wide and must coordinate arrangements for all intermodal through-movement services.

2. MTMC administers the terms of the Container Agreement although MSC continued its responsibility as the procurement agent for containers, and

3. MTMC monitors shipper and carrier performance.

Therefore, in its role as traffic manager and manager of intermodal containers, MTMC, in the early 1980s, began the process of developing a Container Management System (CMS). In 1984, TSC completed a functional description and a preliminary economic analysis outlining the costs and benefits of the preferred system. However, due to budget cuts following from the Gramm-Rudman-Hollins Act of 1985, the system has not been developed. MTMC has devoted subsequent planning to a broadened cargo visibility system, but the only concrete development has been the Automated Carrier Interface (ACI) project, which is described later in this section.

A system visibility and flow control capability like CMS would enhance MTMC's performance in both its peacetime and wartime functions. Specifically, the capability would:

1. Provide in-transit visibility of assets from the time the container enters the transportation pipeline until the shipment is delivered,
2. Provide sufficient flexibility to permit immediate responsiveness to meet users' needs, (e.g., for diversion or call forward),
3. Assure that containers move expeditiously, that they are accounted for, that empties are relocated to provide maximum use, and that backhaul and cross-haul are minimized,

4. Provide near real-time flow of information between movement control personnel and shipping and receiving activities, to expedite container movement,
5. Minimize the risk of container congestion and/or scarcity, and
6. Provide information to monitor carrier and system performance.

Currently, container information is received by MTMC from various sources, much of which must be manually entered into existing systems. This results in information not received in a timely manner to ensure the best asset management, and introduces occasions for errors. The goal is to permit computer-to-computer exchange of status information with other DOD and commercial carrier systems. It would cover containers acquired under Container Agreements as well as MILVANs.

A planned feature for CMS was the incorporation of an Automated Carrier Interface providing an automated link between ocean carriers and MTMC using Electronic Data Interchange (EDI) standards. This development has proceeded and the first phase, covering the exchange of cargo booking information, has been implemented with several carriers on the east and west coasts. The second phase of ACI will involve automated exchange of billing information between the carriers and MSC. The third phase, equipment control, will give MTMC access to carriers' container-movement data while avoiding duplication of their systems.

While it is beyond the scope of this report to present details of the system integration planned for CMS or a similar capability (the reader is referred to the Functional Description and the Preliminary Economic Analysis of CMS), the lack of this capability has been of concern to MTMC and to DOD shippers interviewed during the course of this study. With the expected volumes of container traffic that would occur during emergencies or wartime, the system visibility and flow control capability is seen as essential to an efficient container-oriented system. The requirements for tracking container contents has also been identified. This would permit further visibility of cargo, particularly critical supply items.

The requirement for container visibility and control information has led several Services to initiate their own container tracking systems. (See Section 8.4 for a discussion of the Navy's CMS/TOMS project and Section 7.5 for a discussion of the Air Force's CMOS system). In addition, the Defense Logistics Agency has identified a Container Tracking System (CTS) as the second increment in its DLA Standard Automated Transportation System, and they are about to begin design and development work. From the perspective of the Defense Transportation System, it would be preferable for MTMC, as DOD's Single Manager for Intermodal Transportation, to develop a common user system for container visibility and flow control.

9.4 Container Requirements and Availability Study

MTMC is responsible for developing a Container Requirements and Availability Study (CRAS) (U), one of the major container program areas assigned under DODD 4500.37. CRAS studies have been conducted by MSC and MTMC, with the latest CRAS - 85 (U) conducted by MTMC. The two previous efforts addressed container availability to meet the requirements outlined in SMRP-83 (CRAS - 83 (U)) and to meet the requirements outlined in SMRP-84 (CRAS - 84 (U)).

CRAS - 85 (U) drew its requirements from the 1984 DOD Sealift Study, based upon the Defense Guidance for 1985-1989 objectives for a global, conventional war. Time-phased requirements for containerized ammunition and non-ammunition dry cargo were used as the basis for the analysis.

Inventories for standard dry containers of various lengths were presented for U.S. carriers and container leasing companies and for containers owned by allied countries. Container availability addressed the time-frame in which the inventory could be used for DOD shipments, given that containers are usually in transit with a small percentage of the fleet in off-hire status. Estimates of the availability of containers and chassis in CONUS for the current year and for 1988 were included.

The analysis of CRAS - 85 (U) focused upon whether the time-phased container requirement could be met by the estimated time-phased availability. The study

draws several conclusions based upon alternative scenarios of container availability.

CRAS - 85 (U) includes observations about limitations of the analysis which should be addressed in future versions of CRAS. First, the study assumed no competing requirements for containers, an unrealistic assumption during wartime when critical civil requirements and cargo movements to support a war effort would continue. In addition, no constraints on container handling, port, or line-haul capabilities were assumed. The requirement for an automated container management system was also indicated. Also, because lessors do not track containers once they are leased to ocean carriers (most U.S. lessor-owned containers are leased to foreign carriers), the location of these and foreign-owned containers in CONUS were not available for the study.

CRAS - 85 (U) suggests several further studies/analyses:

1. Assessment of capability to move containers in CONUS by rail and chassis to container stuffing locations and the capability of ports to handle them,
2. Determination of depot and plant outload capabilities for sourced supplies,
3. Estimation of the location of foreign-owned containers in CONUS and U.S. containers leased to foreign carriers.

MTMC is currently beginning a new version of CRAS, which is expected to address issues raised in CRAS - 85 (U). The most significant change is expected to be an emphasis on the development of container requirements estimates. MTMC intends to address time-phased requirements by unit and container type, i.e., requirements for special containers (flatracks, SEASHEDs, refrigerated containers, etc.). Sensitivity analysis around various levels of containerization and regional container outload requirements for current and out-years will be included. Requirements estimates by unit type for the Services will provide guidance on planning for container use and outload not previously available.

Other information not considered in previous CRAS studies will be included. For example, estimates and impacts of port throughput capabilities, container cycle time, container attrition, competing demands, availability of container handling equipment and inventories and availability of non-standard containers will be addressed. Therefore, the next study will provide more realistic estimates based upon system constraints. MTMC also plans to begin identifying automated systems which could provide the on-going capability for estimating container requirements and the system-wide impacts of specified containerization levels.

9.5 Summary Observations/Issues

MTMC, MAC and MSC have key responsibilities for aspects of the DOD container distribution system. The following initiatives would provide considerable benefits for planning and executing wartime container movements.

1. Negotiation of an emergency container acquisition agreement with the commercial sector to help ensure that DOD's requirements will be met. With a limited organic fleet, DOD must ensure that commercial assets are available to implement its wartime container-oriented logistics system. Otherwise, concepts, policies, doctrine and planning for container cannot be implemented.
2. Development of an automated system visibility and flow control capability to manage and monitor containerized traffic throughout the transportation system. During surge conditions such as those experienced in wartime, the capability to track containers and container contents will be critically important.
3. Development of a model to estimate container requirements. Previous CRAS studies have focused upon container availability to meet a requirement defined in a strategic mobility study. Therefore, sensitivity analysis has not been conducted around the requirement itself. While CRAS - 85 indicated numerous ways in which the analysis could be improved, one important consideration was lacking--developing, as an integral part of future CRAS studies, automated procedures for testing the impacts of container policies and for estimating container requirements. CRAS modeling capability should ultimately interface

with existing inter- and intra-theater models. Initially addressing Service requirements and CONUS impacts would, however, provide information not previously developed.

4. As noted in Section 7.0, MAC needs estimates of container airlift requirements for all Services so that planning and implementation for throughput at aerial ports can be performed.

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10.0 DELIBERATE PLANNING AND CONTAINERIZATION

The degree of integration of containerization into the DOD distribution system has implications for the deliberate planning process. While it is beyond the scope of this study to explain this process of developing operations plans (OPLANS) in detail, aspects germane to containerization are considered.

10.1 Designation of Cargo for Containerization

OPLANS are developed in the deliberate planning process, using the automated Joint Operations Planning System (JOPS), to describe implementation of concepts of operation for various scenarios of U.S. involvement in world and regional conflicts. The basis of an OPLAN is the force requirement and the time-phased arrival in the theater of combat and supporting units and supplies. Requirements are generated by the supported Commanders-in-Chief (CINCs) and developed into Time Phased Force and Deployment Data (TPFDD). CONUS and strategic lift movements are driven by the required delivery date of both forces and supplies to satisfy OPLAN requirements.

In planning for forces to arrive in theater, CINCs have the responsibility to indicate in JOPS whether cargo should be containerized. The Institute for Defense Analysis (IDA) recently completed a study for U.S. Central Command (USCENTCOM), Increased Use of Containerization (1988), that addresses the use of unallocated non-self-sustaining containerships for unit deployments.

IDA was tasked to study how these ships might be used to compensate for USCENTCOM's shortfall in strategic lift capability. IDA was also tasked to identify procedures for ensuring that the use of non-self-sustaining containerships are considered in the deliberate planning process.

To determine how to utilize unallocated containership space, the IDA study used USCENTCOM's automated Cargo Containerization System to identify containerizable cargo that was not coded as such. While realizing that it might not always be practical to containerize this materiel, the extent to which sealift shortfalls could be reduced was estimated. IDA also estimated flatrack- and

SEASHED-eligible cargo and estimated the extent to which their use could reduce lift shortfalls.

The deliberate planning system was examined by IDA to determine the method for matching cargo requirements with lift capabilities. Examination of the system indicated that non-containerizable cargo must be associated with enhanced containerships to ensure their use.

In-theater container handling capability impacts CINCs' containerization decisions. The IDA study indicates that because deployment models do not take system impacts into account, analytic models, e.g., MIDAS, SITAP, should be considered for adaptation for the deliberate planning process.

There is also an indirect role in deliberate planning for Service policies on containerization, particularly of unit equipment. (See sections 4.1, 6.4 and 7.4 above.) Those policies, and the capabilities to implement them, affect the range of options available for deployment and the ability to take advantage of a container-dominated merchant fleet. Explicit Service policies calling for increased containerization of unit equipment would do at least two things: First, it would bring home to unit and installation commanders the forced dependence on containerships for large deployments. Second, it would direct more attention to improving the containerization capability for unit equipment at all transportation nodes, not just at ports.

Designation of cargo for containerization by the CINCs and Service policies on containerization will not be at odds if the OPLAN reflects actual container throughput capacity. The development of container capabilities will be defined by concept and policy. The means, e.g., personnel, equipment, facilities, to accomplish container-oriented distribution must be planned for, funded and implemented. As this implementation progresses, designating UE for containerization can proceed.

10.2 Impacts of Containerization for the TOAs

Planning for the movement of equipment, personnel and supplies in support of an OPLAN is conducted by the TOAs once the time-phased requirements are

determined. As managers of common user strategic lift assets, MAC, MTMC and MSC develop movement tables for sourced units and supplies in the deployment force list after a first gross estimate of transportation feasibility to meet required delivery dates has been completed in JOPS. .

The TOAs evaluate the required moves and develop movement tables. Using its Integrated Military Airlift Planning System (IMAPS), MAC addresses those moves which will be accomplished through strategic airlift. Air system constraints which impact throughput are considered: number and types of aircraft, crews, MHE, ramp space, airfield hours. MAC specifies APOEs as origins to CINC-specified APODs.

Using MAPS II (Mobility Analysis and Planning System), MTMC develops CONUS movement tables for deployment to CONUS SPOEs and APOEs. Installation and depot outload capabilities are critical constraints in MTMC's movement planning, as are rail and truck availability and throughput capabilities of CONUS SPOEs and CINC-designated SPODs.

MSC participates in the OPLAN process using its SEACOP (Sealift Contingency Planning System) model. Based upon SPOEs designated by MTMC, SEACOP develops movement tables to CINC-designated SPODs to meet required delivery times. Constraints include availability of ships, depth of harbor, berth space, load/unload time and ship speed.

The extent to which requirements, especially supplies, are sourced in the TPFDD also impacts planning for and execution of an OPLAN. Designating specific sources permits planning around required outload to support the OPLAN as well as transportation and handling requirements.

The development of the TPFDD in JOPS and the constraints used in the TOAs' models raise issues related to containerization in the logistics system. First, cargo must be designated for containerization in JOPS if it is expected to move in a container. This requires both information on the containerizability of the cargo and policies on container use.

The data used in the TOAs' models to determine system constraints must reflect expected level of container use and real capabilities to execute according to the plan. All of the MAPS II constraints and the IMAPS MHE constraint are impacted by the use of containers. For example, accurate receiving and container outload capabilities (reported to MTMC on DD Form 1726, "CONUS Military Installation Materiel Outloading and Receiving Capability Report"), are essential to determining if the OPLAN can be supported in the CONUS movement phase. Also, line-haul requirements for containers differ from those for breakbulk moves. For example, chassis rather than trailers, and flatcars rather than boxcars may be required.

10.3 Summary Observations/Issues

1. Concepts of and policies for container use must be reflected in the plans, and the plan must be executable at all links and nodes. The plan is flawed if it reflects utilization of a container-oriented distribution system key parts of which are not in place or are not fully functional. The plan is flawed if efficiencies of containerization can be realized or if dependence on containerships is required by vessel availability but these conditions are not reflected in the planning process. The degree to which there is a mismatch between the plan and real operations will determine the extent to which shortfalls or underutilization of capabilities may occur in plan execution.
2. Cargo must be unambiguously identified in the deliberate planning process for eligibility for containerization. The eligibility should include sizing for flatracks and SEASHEDs to ensure that the surface fleet is used efficiently.

11.0 COMMERCIAL TRENDS

The commercial sector is the primary source of CONUS line-haul assets and containers for DOD. This section presents data on world and U.S. container inventories and describes some recent trends in the commercial transportation industry which could affect DOD's container-oriented logistics system.

11.1 Commercial Container Inventories

This subsection presents data on the world and U.S. inventories of ISO containers. Data on standard and special purpose containers are included. Trends in the height and length of standard containers, estimated locations of off-hire, (readily available containers), and ownership and control of the world and U.S. fleets of standard 20-foot containers are presented.

11.1.1 World Container Height and Length

The world inventory of ISO containers consists of approximately 3.6 million ISO units. Table 11.1 describes this fleet by height and length in 1986, the most current data available. The fleet is composed primarily of 20- and 40-foot containers, representing 67 and 31 percent, respectively. Ninety percent of the ISO containers are 8.5' in height, with 20'x8'x8.5' the predominant size (60 percent of the fleet).

11.1.2 World Container Inventory by Type

Table 11.2 lists the world fleet (in units) by type of container, and indicates that the U.S. owns 39 percent of the fleet. As noted in the Table, most (85 percent) of the fleet is composed of standard, dry containers with small numbers reported for the "special" vans. Ninety-one percent of the U.S.-owned fleet is standard, dry containers.

TABLE 11.1: WORLD CONTAINER FLEET, BY HEIGHT AND LENGTH, 1986

<u>Height</u>	<u>20-Foot</u>	<u>40-Foot</u>	<u>35-Foot</u>	<u>Other</u>	<u>Total</u>
8-Foot	202,000	2,000	*	13,000	217,000
8.5-Foot	2,185,000	1,013,000	36,000	16,000	3,250,000
9-Foot	*	8,000	0	0	8,000
9.5-Foot	2,000	93,000	0	8,000	103,000
Other	36,000	7,000	*	*	43,000
TOTAL	2,425,000	1,123,000	36,000	37,000	3,621,000

Source: Containerisation International, September, 1986.

* Negligible amount

TABLE 11.2: WORLD AND U.S. CONTAINER FLEETS BY TYPE, 1986

	<u># Units</u>	<u>% Total</u>	<u># U.S.-Owned</u>	<u>% U.S.</u>
Standard	3,077,000	85.0	1,303,000	91.1
Open-top	156,000	4.3	34,000	2.4
Insulated	70,000	1.9	3,000	.2
Refrigerated	104,000	2.9	37,000	2.6
Flatrack	65,000	1.8	25,000	1.8
Ventilated	35,000	1.0	5,000	.4
Tank	33,000	.9	3,000	.2
Platform	32,000	.9	7,000	.5
Bulk	26,000	.7	4,000	.3
Other	23,000	.6	7,000	.5
Total	3,621,000	100.0	1,428,000	100.0

Source: Containerisation International, September 1986 and the U.S. Maritime Administration's Inventory of American Intermodal Equipment, 1987 (to be published).

Note: The use of two data sources for container inventories results in minor discrepancies between some Tables of this Section.

11.1.3 Ownership of Standard Containers

As noted above, most of the world container inventory is composed of 20- and 40-foot standard containers. Table 11.3 lists the primary countries of ownership of this standard fleet comprising two million units. American companies are the primary owners of both 20-foot (40%) and 40-foot (54%) dry vans. Additionally, most of the world inventory is owned by U.S.-allied countries.

11.1.4 Trends in Length and Height of U.S.-Owned Dry Containers

The United States is the primary owner of dry containers, of which most are 20 and 40 feet in length. Figure 11.1 shows changes in the length of this fleet over the last thirteen years.

Since 1974, the inventories of both 20- and 40-foot standard containers have increased by more than three-fold. The 20-foot fleet has grown from approximately 212,000 units to approximately 798,000 units, and the 40-foot fleet has grown from approximately 138,000 units to nearly 470,000 units. (Note: Some of the apparent decline in containers between 1985 and 1986 may be due to unreported US Lines containers, particularly 40-footers, rather than an actual decline in the container inventory).

Figures 11.2 and 11.3 show the changes in the height of the 20- and 40-foot U.S.-owned dry container fleet. The decline in 8-foot high containers has been steady for 20- and 40-footers since 1973. In fact, for the 20-footers, there has been a turnaround in the dominant height. In 1973 8-foot containers represented 88 percent (140,000 of 160,000 units) of the 20-foot fleet, but by 1985 8-footers represented less than one percent of the 835,000 unit fleet. For 40-foot containers, 8.5 feet has been the dominant height. In 1973, 8-foot forties represented approximately five percent of the 105,000 unit fleet; in 1985 8 foot high containers accounted for less than one percent of the 439,000 unit 40-foot fleet.

TABLE 11.3: OWNERSHIP OF DRY VANS, BY NATIONALITY OF COMPANY, 1986

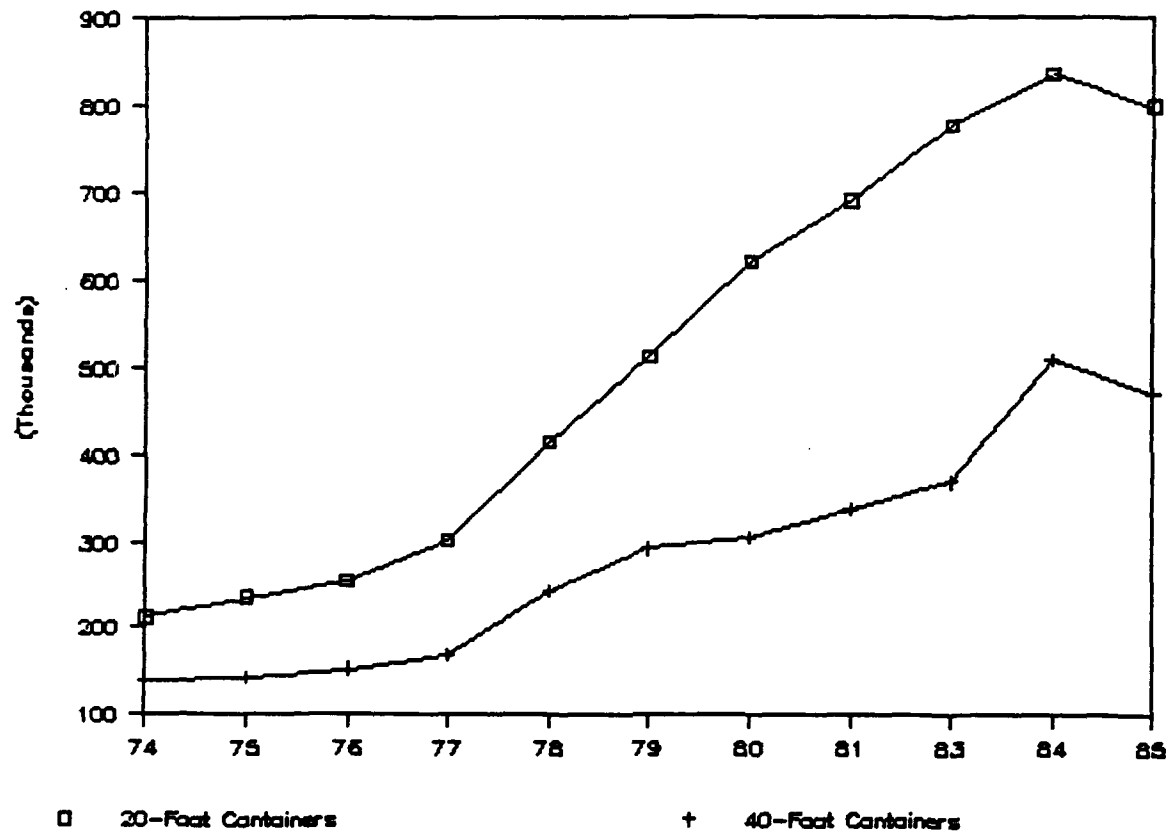
Country	20' Containers (%)	40' Containers (%)
United States	820,000 (40%)	528,000 (54%)
United Kingdom	270,000 (13%)	93,000 (10%)
Italy	127,000 (6%)	24,000 (2%)
Japan	97,000 (5%)	66,000 (7%)
Taiwan	80,000 (4%)	76,000 (8%)
FRG	79,000 (4%)	23,000 (2%)
USSR	69,000 (4%)	7,000 (1%)
France	66,000 (3%)	7,000 (1%)
PRC	39,000 (2%)	14,000 (2%)
GDR	33,000 (2%)	* *
Hong Kong	32,000 (2%)	26,000 (3%)
Netherlands	26,000 (1%)	6,000 *
Other	292,000 (14%)	99,000 (10%)
TOTAL	2,030,000 (100%)	969,000 (100%)

* Negligible amount

Source: Containerisation International, September 1986.

FIGURE 11.1

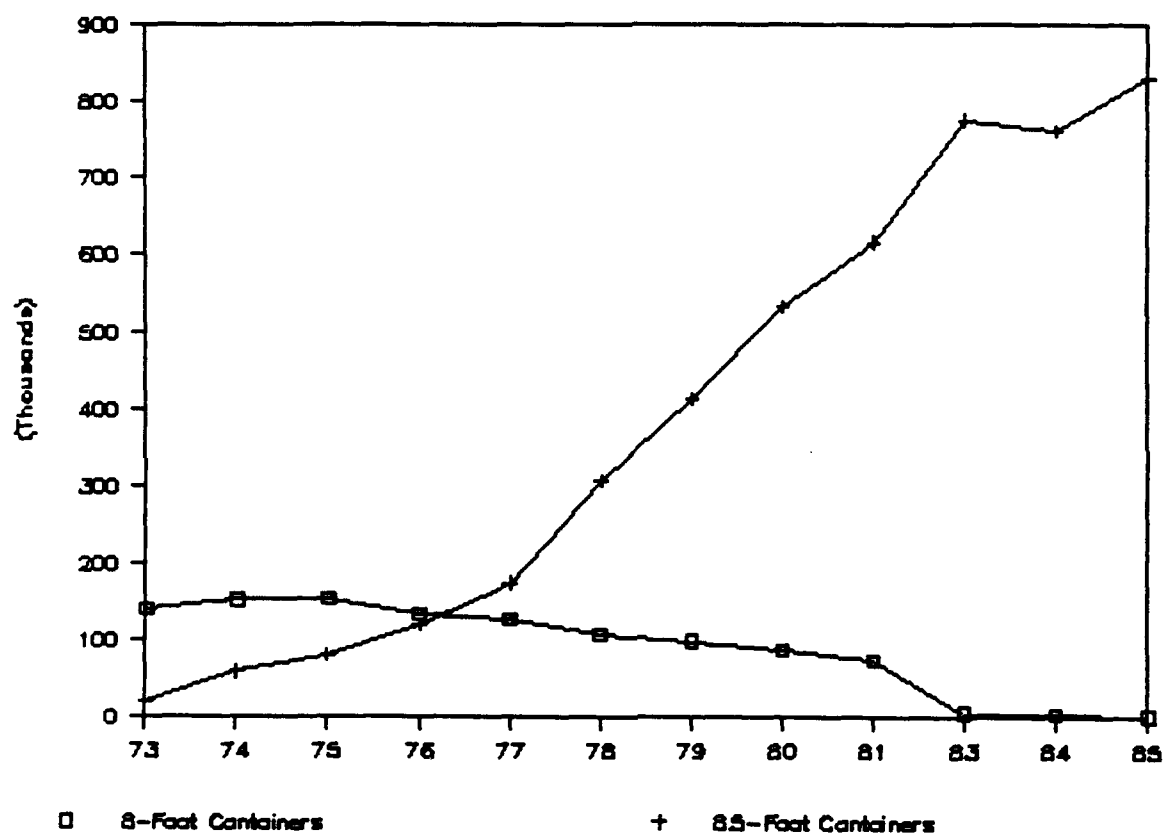
U.S.-OWNED DRY CONTAINERS, BY LENGTH



Source: U.S. Department of Transportation, U.S. Maritime Administration,
Inventory of American Intermodal Equipment, various years.

FIGURE 11.2

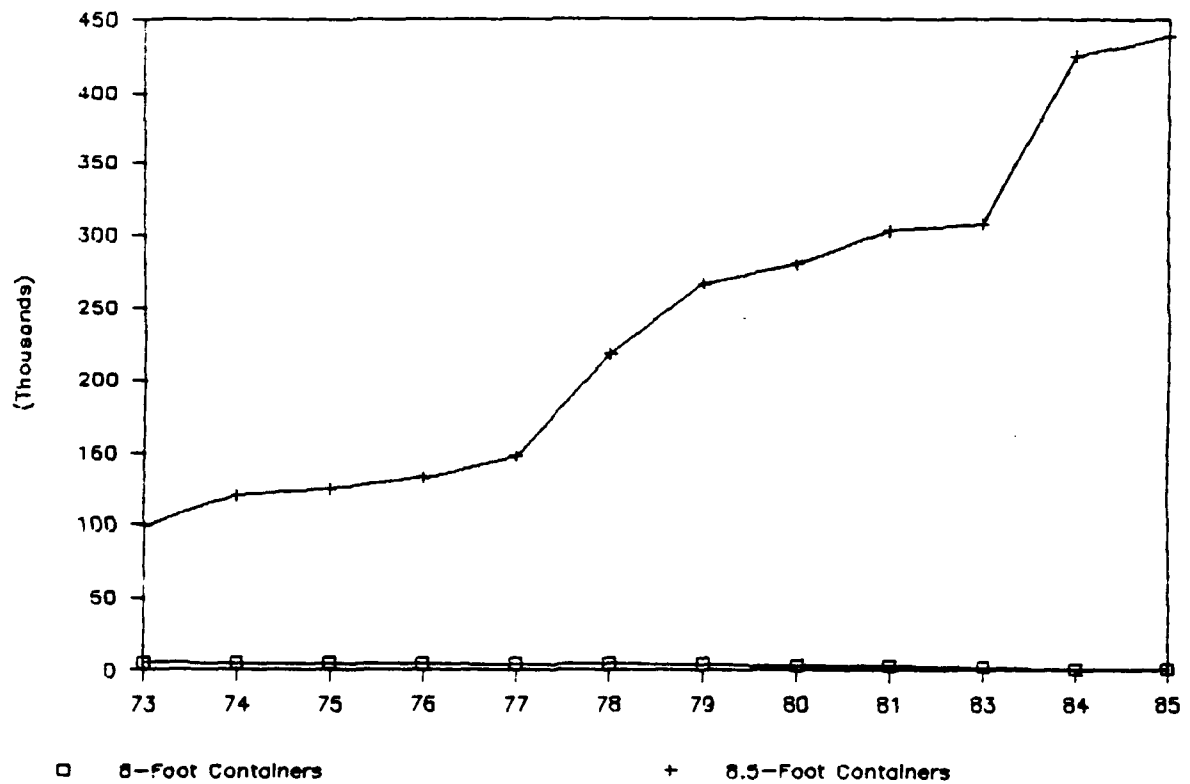
U.S.-OWNED 20-FT DRY CNTRS., BY HGT



Source: U.S. Department of Transportation, U.S. Maritime Administration, Inventory of American Intermodal Equipment, various years.

FIGURE 11.3

U.S.-OWNED 40-FOOT DRY CNTRS., BY HGHT



Source: U.S. Department of Transportation, U.S. Maritime Administration,
Inventory of American Intermodal Equipment, various years.

11.1.5 Ownership and Control of U.S.-Owned 20-Foot Dry Containers

This subsection presents data on ownership and control of the U.S.-owned, twenty-foot dry container fleet. These data are presented because they represent the largest block of U.S.-owned containers and the preferred length around which DOD has planned.

Table 11.4 presents data on the ownership of this segment of the fleet. As shown in the Table, most U.S. containers are owned by leasing companies, representing 39 percent of the world fleet and 97 percent of the U.S. fleet. U.S. carriers own few containers, approximately one percent of the world fleet. The ocean carriers rely upon containers furnished by the leasing companies.

Table 11.5 shows the control of these containers. Although U.S. leasing companies own the single largest segment of the world fleet, foreign ocean carriers control most (78%) of the fleet. U.S. companies control an estimated thirteen percent of the world fleet. Therefore, the availability of containers leased to foreign carriers could have important impacts for DOD if large numbers are required for an emergency. U.S. lessors control nearly 200,000 units. These containers are off-hire and are available for immediate use.

11.1.6 Location of the Off-Hire Fleet

During the study conducted for PM AMMOLOG on ammunition-serviceable container (see Section 4.0 for details), TSC estimated the location of off-hire containers. These are the containers not in current use, usually in the hands of container lessors. Beyond containers already in the hands of carriers and available through normal Container Agreement procedures, these are the most readily available containers in the event of an emergency. The maps presented as Figures 11.4 and 11.5 indicate the estimated world-wide location and CONUS location of the off-hire fleet in 1986.

The largest group of off-hire containers (approximately 105,000 units) were estimated to be off-hire in CONUS. The second largest group was located in Europe (88,000 units), followed by Asia (56,000 units).

TABLE 11.4: OWNERSHIP OF 20-FOOT DRY CONTAINERS, 1986

	U.S.-Owned	Foreign-Owned	Total
Lessor-Owned	796,000 (39%)	381,000 (19%)	1,177,000 (58%)
Carrier-Owned	18,000 (1%)	747,000 (37%)	795,000 (38%)
Other	6,000 (0%)	82,000 (4%)	88,000 (4%)
Total	820,000 (40%)	1,210,000 (60%)	2,030,000 (100%)

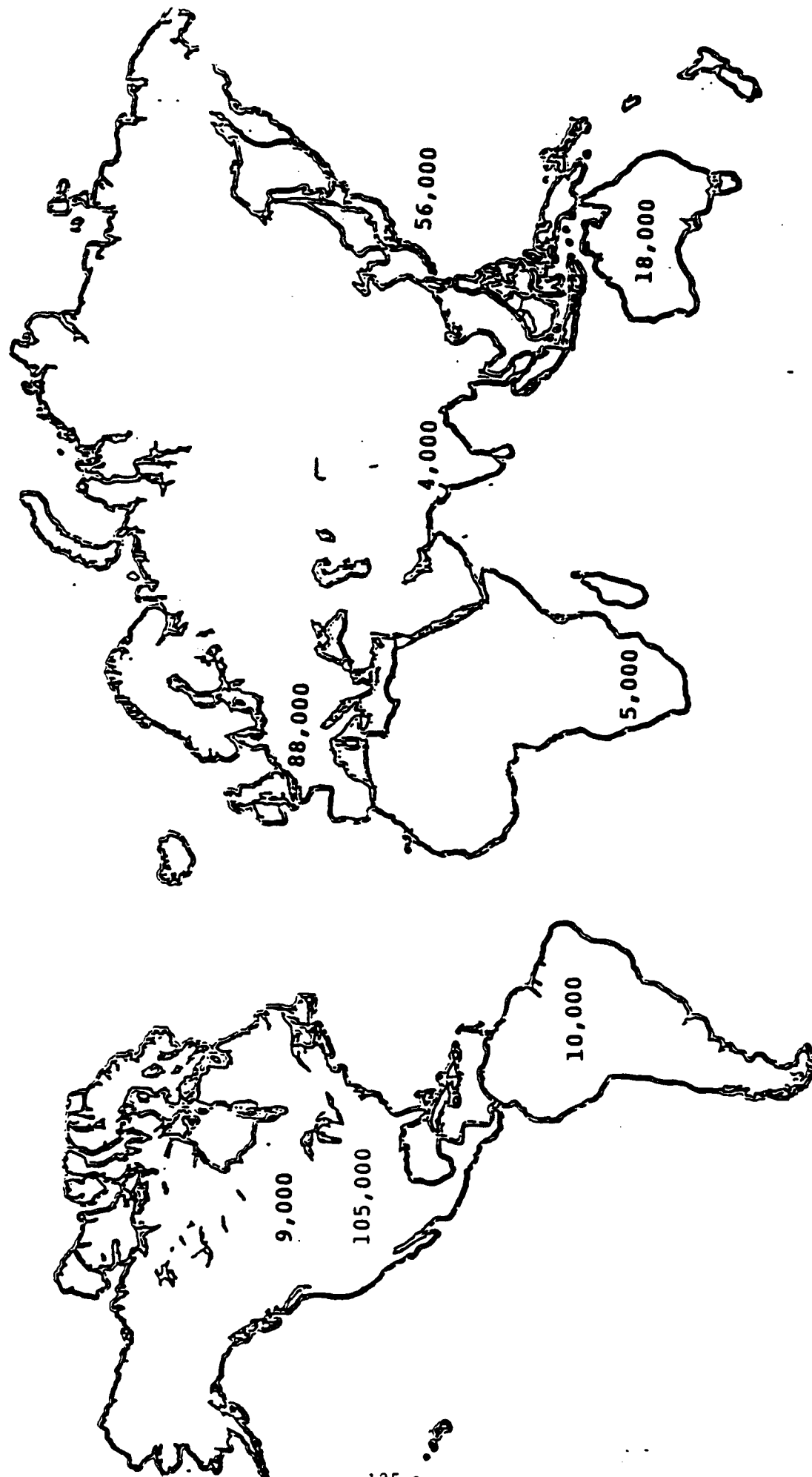
Source: Containerisation International, September, 1986.

TABLE 11.5: CONTROL OF 20-FOOT DRY CONTAINERS, 1986

	<u>U.S.</u>	<u>Foreign</u>	<u>Total</u>
Lessor-Cntrl.	199,000 (10%)	95,000 (5%)	294,000 (15%)
Carrier-Cntrl.	55,000 (3%)	1,593,000 (78%)	1,648,000 (81%)
Other	6,000 (0%)	82,000 (4%)	88,000 (4%)
Total	260,000 (13%)	1,770,000 (87%)	2,030,000 (100%)

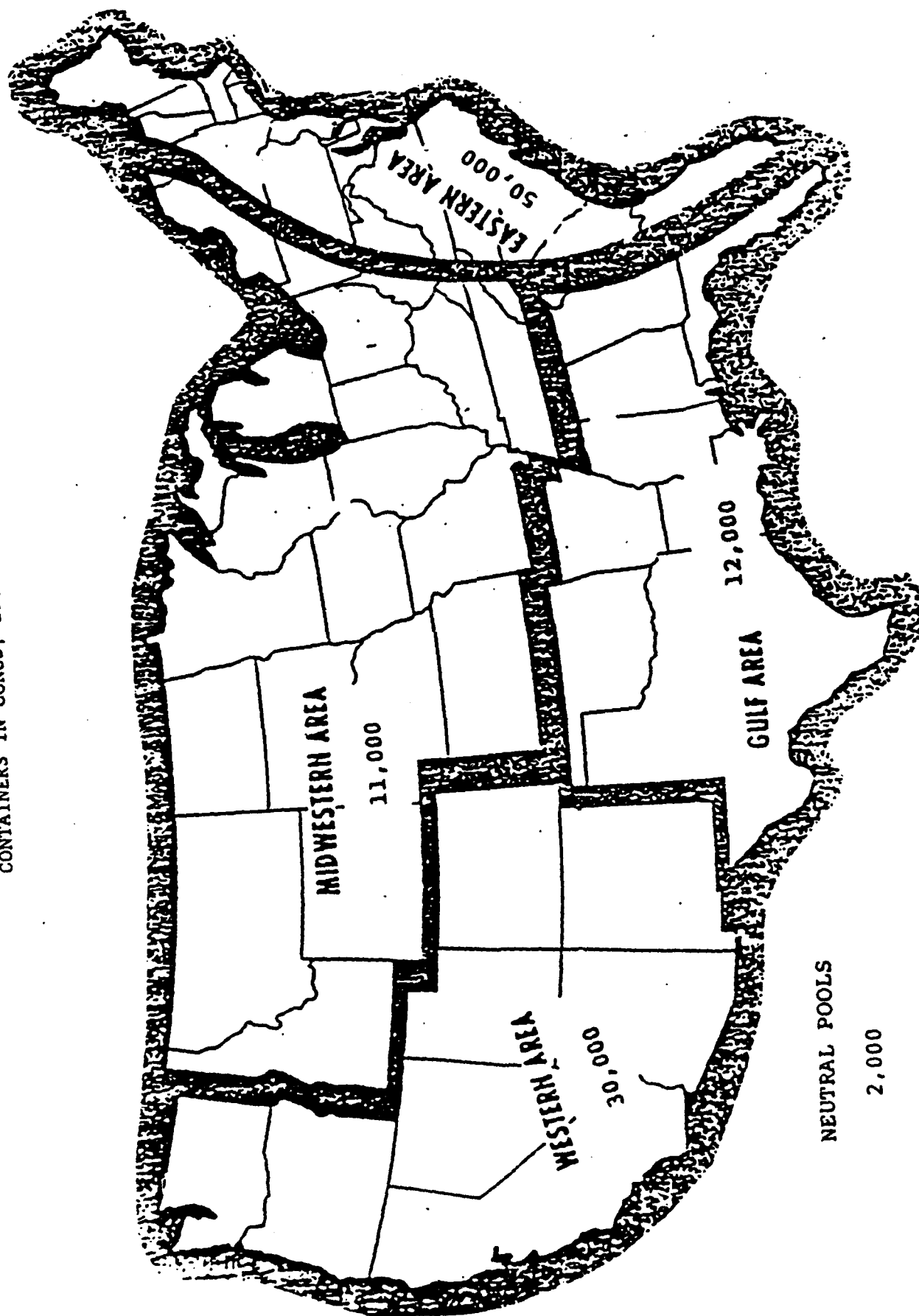
Source: Containerisation International, September, 1986; interviews with industry officials.

FIGURE 11.4 LOCATION OF OFF-HIRE TWENTY-FOOT
DRY CONTAINERS, 1986



Source: U.S. Department of Transportation, Transportation Systems Center, Availability of Ammunition-Serviceable Containers, Cambridge, MA: 1987.

FIGURE 11.5 LOCATION OF OFF-HIRE TWENTY-FOOT DRY
CONTAINERS IN CONUS, 1986



Source: U.S. Department of Transportation, Transportation Systems Center, Availability of Ammunition-Serviceable Containers, Cambridge, MA: 1987.

Figure 11.5 shows that most (48 percent or 50,000 containers) of the off-hire fleet are located on the East Coast, followed by the West Coast with 29 percent (30,000 containers). These estimates are based upon industry interviews and the following assumptions:

1. Off-hire rates vary between 15 percent and 35 percent, with the norm--25 percent--used for this estimate. Industry interviews confirmed that 25 percent was the prevailing off-hire rate.
2. Approximately 36 percent of off-hire containers were located in CONUS. The range varies between 30 percent and 40 percent. Economic conditions may cause these rates to vary, but generally the United States is a net importer, causing containers to "pile up" in CONUS.

11.1.7 Future Inventories

The preceding sections present data from the most recent censuses of container inventories. Some comments about future inventories are also appropriate.

According to Containerisation International, the world fleet of containers now exceeds five million twenty-foot equivalent units (TEUs). At the time of the 1986 census, the fleet numbered 3.6M units of all types (4.8M TEUs). Container production is expected to continue to exceed scrappage, resulting in net gains for the inventory.

In the 1970s and early 1980s, growth in the inventory resulted from conversion of breakbulk routes to containerized ones. As the container industry matures, expected growth in containerization may come more from trade growth than from further conversions.

There are no indications in industry literature that standard containers are on the decline although their ownership may change. For example, in 1987 and 1988, ITEL bought Flexi-Van's container inventory and Genstar bought Gelco-CTI's. In March 1988, the top ten leasing companies owned nearly 43 percent of the world fleet in TEUs (Source: Containerisation International, May, 1988).

11.1.8 Commercial Inventory Issues

In order for DOD to evaluate changes and trends in the commercial sector, it must define its own requirements. The following summarizes key commercial container inventory issues for DOD.

1. Inventory of containers to meet DOD requirements: standards and specials.

Standard containers dominate the world fleet. The U.S.-owned fleet of both 20- and 40-foot standards has increased since the early 1970s. The world fleet continues to grow as well. The height of standard containers is almost entirely 8.5', a dimension of which DOD elements must be aware in case planning has assumed commercial availability of 8-footers.

Special containers represent a small part of the world container fleet. DOD's container requirement for standards and specials must be determined and then evaluated against this fleet to identify potential shortages. Without a clear requirements statements, impacts of trends in the world and U.S. inventories cannot be judged adequately. However, it is likely that availability issues will be greater for special containers, especially, if there is greater containerization of unit equipment.

2. Ownership/control of containers

U.S. companies are the single largest owner of the world container fleet, of which most are owned by container leasing companies. Much of the world fleet is, however, in the hands of foreign carriers, e.g., 78 percent of the fleet of 20-foot standards. The extent to which these will be available to DOD, if required, should be investigated.

3. Location of containers

Although containers tend to "pile up" in CONUS because the U.S. is a net importer of goods, many off-hire containers are located in foreign depots. DOD's time-phased requirements must be estimated to determine if time required to acquire containers from overseas causes potential shortfalls.

4. For ammunition, condition of containers

Current Coast Guard standards for ammunition containers may preclude the use of as much as 50 percent of the fleet, based upon a sample of off-hire, standard 20-foot containers conducted in 1986.

5. Competition for commercial containers

Even in times of emergency, DOD cannot assume that container assets are available entirely for its use. Evaluation of the adequacy of the fleet to meet DOD requirements must also assess the impact of on-going regular and critical commercial trade as well as military essential movements in support of a war effort. Also, allied requirements may compete for commercial containers.

6. Container manufacturing base

In the event of container shortfalls, the production of new containers may be required. However, the U.S. is not currently a manufacturer of containers. The degree to which the industrial base must produce additional containers and the time-frame in which this must be accomplished needs to be evaluated in light of expected shortfalls.

7. Evaluation of economic trends

Both world-wide economic trends and the relative strength of the U.S. dollar abroad can cause changes in the size, characteristics, ownership, control and location of the commercial fleet. Key variables that impact availability for DOD use should be estimated.

The adequacy of the commercial sector to support DOD in wartime necessitates clear requirements against which current inventories and expected trends can be evaluated. Following from this, potential problem areas in terms of container inventories themselves, and critical conditions, variables, and scenarios under which problems could occur can be identified. During the course of this study,

TSC has determined that requirements have not been specified to the extent required to conduct this evaluation. The newest CRAS study, in progress by MTMC, is expected to produce alternative requirements estimates which will provide the foundation for decisions on container use and for evaluation of commercial inventory adequacy.

11.2 The Commercial Intermodal Climate - 1988

The transportation environment in 1988 is shaped largely by regulatory reforms of the late 1970s and 1980s. Deregulation has particularly impacted competition among the modes with intermodalism emerging, particularly in the last few years.

Congress deregulated the trucking industry with the passage of the Motor Carrier Act of 1980 (MCA) stating that a, "safe, sound, competitive and fuel efficient motor carrier system is vital to the maintenance of a strong national economy and a strong national defense." The passage of the MCA was intended to end the domination of trucking market by a few large carriers. And, after MCA passage, numerous firms emerged in the trucking market. However, according to Dunn and Bradstreet, the number of business failures increased markedly at a rate of nearly 26 percent per year since 1980, and approximately 60 percent of the failures since 1980 have been smaller, new-to-the-market, local carriers (generally one or two truck trailer operations).

In contrast, the large interstate carriers have continued to dominate the market. In fact, their control of the market place compared to small truck companies has increased since deregulation. One report from the American Trucking Association described large scale interstate motor carriage as a "closed club with a dwindling number of members."

For the customer, truck carriage represents door-to-door service with which the railroads have had to compete. The Staggers Act of 1980 deregulated the railroad industry permitting it more rate and service flexibility. Railroads were also permitted to "rationalize" (abandon) low-use, uneconomical routes. The railroads had seen the erosion of their business to trucks for two decades

as the rail market to "smokestack industries" dwindled and trucks provided service dependability to the rest of the market.

At the time of deregulation another phenomenon occurred, namely, a surge in containerized imports into the U.S. Therefore, with much incoming cargo to be moved, railroads increased intermodal capability to compete with the trucking industry, particularly for long hauls. The container-on-flatcar (COFC) became the primary means for the railroads to provide equivalent service.

By 1984, integrated, multi-modal transportation companies began to emerge. Ocean carriers entered the U.S. intermodal market by joining with railroads to haul containerized foreign trade. For example, American President Companies (APC), the parent of American President Lines (APL) and American President Domestic (APD), entered a ten-year agreement with Union Pacific (UP) railroad for hauling containerized loads. UP provides power, rights-of way and crews, and APC provides the remaining equipment and services. APC also purchased National Piggyback (now American President Distribution Services), the largest inland intermodal freight broker in the U.S., in 1985.

In 1984, APL introduced both 45-foot maritime containers to compete with TOFC and motor carrier service and its first double-stack container train service. Also, for U.S. domestic traffic, APD introduced a 48'L x 8.5'W x 9.6'H container. The domestic container's size was designed to be competitive with the largest single-unit truck trailer allowed on U.S. highways. Domestic and maritime containers can be mixed on the double stack trains. By 1988, twelve ocean carriers were operating double-stack trains dedicated to the movement of imported container loads. While the double-stack trains began as a means to move international freight as an extension of maritime container services, their use for hauling domestic containers may further erode the piggyback trailer system.

In the first merger of an ocean carrier and a railroad, CSX bought Sea-Land's ships and container inventory in 1986. Sea-Land also owned a large intermodal rail yard in New Jersey. (CSX had been the result of the post-deregulation merger of the Chessie System and Seaboard Coast Lines). At the time of the Sea-Land merger into CSX/Sea-Land intermodal, CSX already owned a truck and a

barge company. However, CSX had been oriented to TOFC traffic and, therefore, has embarked upon an intermodal terminal improvement program to provide container handling capability.

The growth of the multi-modal transportation company has fostered the emergence of computer systems both to optimize the scheduling of movements and to provide the customer with in-transit information on shipments. For example, APC plans to permit customer access to financial and logistic information on cargo movements. CSX plans customer access to rate, loss/damage, cargo insurance, and blocking and bracing data as well as movement data.

By June 1988, as reported in Containerisation International, Burlington Northern, which operates the most extensive rail service in North America, had decided to introduce domestic containers and double stack trains, replacing some traditional TOFC service. The growth of domestic containerization appears to be taking hold.

The impacts of CONUS intermodal growth on DOD must be determined. While the preceding discussion highlights recent trends which appear to be increasing container throughput in the U.S., DOD must determine both negative and positive impacts on CONUS wartime movements. Then, ways to capitalize on the benefits and adjust to the costs can be addressed. The following should be examined:

1. Ability of integrated transportation companies to provide multi-modal through-service, monitored by computer tracking systems accessible to the shipper.
2. Impact of double-stack trains on DOD installation requirements (equipment, facilities, personnel), service, and inventory of regular flatcars. MTMC/TEA also identified these issues in its recently published double-stack railway car study.
3. Impact of rail abandonments on service to DOD installations. MTMC currently tracks proposed abandonments.

4. Potential erosion of the ISO container standard as railcars and trucks accommodate 8.5-foot wide units for domestic moves.
5. Effect of the current competitive intermodal climate on the inventory of truck chassis in CONUS.
6. Impact of an increasing number of inland intermodal container handling hubs.

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12.0 SUMMARY CONCLUSIONS AND ISSUES

The previous sections have presented information on the development of DOD's container-oriented distribution system. Study objectives which have been addressed in Volume I of this report include:

1. Provide documentation of DOD containerization programs and identify issues around the use of containers in wartime. An overview approach was specified whereby general issues related to DOD's optimal use of a commercial delivery system, which is container-dominated, would be identified. The emphasis is on ISO containers used as the transportation "envelope", but work- and live-in containers (tactical shelters) are addressed when relevant.
2. Highlight unresolved issues. This study is intended to indicate those areas where the integration of containers has not been achieved or where the impacts of containerization have not been fully evaluated.

Previous Sections of this volume present the historic documentation and issue identification, with summary observations and issues included at each section-end. This section focuses upon objective 2, above, and presents an overview of open issues for DOD container distribution which require further action.

12.1 Container Concepts/Policies

Services do not have comprehensive, written policies for container use based upon a system-wide concept of container distribution. This is not to say there are no Service container policies. Containerization concepts to support specific programs has been addressed in considerable detail, e.g., Army resupply, Marine Corps Field Logistics System, Navy Construction Battalions, Air Force Air Movement System. But some areas have received little attention, particularly policies regarding surface deployment of Army and Air Force unit equipment.

To the extent that explicit concepts and policies provide "roadmaps" for planning execution under various scenarios, the overall guidance to ensure that all subsystems will form a seamless distribution system is lacking. In effect,

many distribution systems exist and may compete rather than interface with each other. Several of the issues listed below result from the gaps in concepts and policies to provide system-wide guidance.

No full systems analysis of the impact of container usage in wartime has been conducted. Therefore, identification of all critical constraints and identification of alternative solutions has not occurred.

12.2 Container Requirements

Wartime time-phased container movement requirements are not fully known and estimation procedures have not been fully developed. Therefore, the adequacy of commercial sector inventories cannot be determined. While the inventory of standard containers may be adequate, special containers which may be needed for unit equipment are not plentiful. Alternatives for eliminating shortfalls should be developed.

12.3 Container Acquisition

Although DOD relies on the commercial sector for provision of containers and peacetime Container Agreements with ocean carriers are likely to continue early in a deployment, an agreement to obtain containers directly from container lessors in an emergency is not in place. This could be especially critical for acquiring large numbers of commercial containers to augment the MILVAN fleet to carry ammunition aboard dedicated ships. Given neither a comprehensive requirement estimate nor an in-place method to acquire large numbers of containers, the container-oriented distribution system is on an unsure foundation. Additionally, allocation of containers if shortfalls exist requires a method for prioritizing allocation among competing uses.

12.4 Force Structure including Civilian and Host Nation Support

Planning the number and capabilities of support units should reflect the character and volume of the cargo throughput. Military, civilian and host nation support should be coordinated. With incomplete estimates of either container movement requirements or container handling capabilities, the ability

to develop sufficient organic capability and assure at least a clear understanding of the ability to accomplish the cargo movements in required time-frames is unknown.

12.5 Facility Readiness

Undefined concept and policy areas cause inadequate nodal preparation for container throughput. Transportation system nodes which are expected to handle containers, e.g., CONUS installations, ammunition plants, and depots, theater distribution points, aerial and ocean ports, must have appropriate container handling equipment, materiel handling equipment and physical facilities.

12.6 Transition to Wartime Conditions

Peacetime distribution procedures will not continue in wartime. To mitigate transitional disruptions, regular incorporation of wartime procedures in peacetime and/or exercises to practice wartime container distribution should occur.

12.7 Special Delivery Systems: Containerized Ammunition Distribution System (CADS), Logistics Over the Shore (LOTS) and the Air Movement System

CADS requires further attention. The organic fleet of CADS MILVANS is inadequate for wartime ammunition movements. The concept of augmenting the organic fleet by integrating commercial containers into CADS has not been achieved. The issue of ISO compatibility for the Palletized Loading System calls for high level review. Issues around container condition criteria which currently limit the number of containers available to carry ammunition should be resolved.

The LOTS subsystem is based upon a coherent concept and policy, and planning for expected container throughput has been conducted. Technical problems due to the operational environment have not been resolved and new doctrine has not been tested. Therefore, the over the shore discharge of containers has not yet been executed as planned.

The Air Movement System presents difficult intermodal challenges. The tracking of ISO tactical shelters and containers used as unit equipment should occur as these represent the minimum container airlift requirement for which MAC must prepare. There is no clear picture of container handling capability in the face of a rapidly growing requirement to deploy units by air with their organic containers and tactical shelters. Also, regular exercise of the system in peacetime has not occurred.

12.8 Integration of Container Policy and Deliberate Planning

The use of containers in the distribution system should be reflected in the deliberate planning process. Avoidance of shortfalls and excesses in OPLAN execution should be the goal. Therefore, realistic estimates of container use and its implications for movement scheduling by the TOAs must be reflected. Also, unambiguous identification of containerizable cargo should be included in TPFDDs to permit optimum ship utilization.

12.9 System Visibility and Flow Control

A system to manage container distribution under wartime conditions is required. From the perspective of the Defense Transportation System, a common user system for container visibility and flow control is preferred. Such a system would generate peacetime management benefits in addition to its wartime command and control features.

12.10 Intra- and Inter-Service Coordination

Management of the container-oriented logistics system requires attention provided through a single point at a level to afford visibility and coordination. Decentralization of oversight aggravates lack of system integration. Also, inter-Service coordination, particularly when one Service impacts the performance of another, is required. This is particularly important with the Army which represents a large portion of the movement requirement and, therefore, greatly impacts the surface and air transportation segments. Both intra- and inter-Service policy coordination and communication enhance the development of a coherent distribution system.

12.11 Coordination with the Commercial Sector

There is no established mechanism for on-going interaction between DOD and the commercial sector on container issues. Coordination and communication on fulfillment of DOD requirements is essential. DOD needs information exchange with the commercial sector on many issues including container inventories and availability, container and intermodal trends that impact the DOD distribution system, and advanced technologies in equipment and automated tracking.

This volume identifies issues around optimizing cargo delivery in a container-dominated commercial environment. Determining optimal container use requires a systematic approach to and integration of the parts that impact one another. On-going procedures rather than ad hoc efforts to determine continuing changes that impact the container oriented distribution system from within and without DOD are required. Volume II outlines recommended actions in each of the preceding issue areas to achieve a system which optimizes the use of containers.

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APPENDIX 1

DOD DIRECTIVE 4500.37, "MANAGEMENT OF THE DOD
INTERMODAL CONTAINER SYSTEM"



Department of Defense DIRECTIVE

April 2, 1987
NUMBER 4500.37

USD(A)

SUBJECT: Management of the DoD Intermodal Container System

- References:
- (a) DoD Instruction 4500.37, "Use of Intermodal Containers, Special-Purpose Vans, and Tactical Shelters," March 17, 1981 (hereby canceled)
 - (b) DoD Instruction 4500.45, "DoD Transportation Policy Council," April 24, 1984
 - (c) DoD Instruction 4100.14, "Packaging of Material," July 2, 1980
 - (d) DoD Instruction 4100.33, "Operation of Commercial Activities," September 9, 1985
 - (e) through (g), see enclosure 1

A. REISSUANCE AND PURPOSE

This Directive:

1. Reissues reference (a) to update policy, procedures, and responsibilities for the development and management of a fully interrelated DoD and commercial intermodal container system.
2. Ensures a coordinated effort in the development and adoption of a container-oriented distribution system with standard equipment, policies, and procedures.
3. Integrates the development and management of the DoD intermodal system with the functions of the DoD Transportation Policy Council (DTPC) (reference (b)).

B. APPLICABILITY AND SCOPE

This Directive:

1. Applies to the Office of the Secretary of Defense (OSD), the Organization of the Joint Chiefs of Staff (OJCS), the Military Departments, the Unified and Specified Commands, and the Defense Agencies (hereafter referred to collectively as "DoD Components"). The term "Military Services," used herein, includes the Army, Navy, Air Force, and Marine Corps.
2. Applies to the United States Coast Guard (USCG) and to the Maritime Administration (MARAD) by agreement with the Department of Transportation (DoT).
3. Includes DoD policies for the use of intermodal containers, special-purpose vans, and tactical shelters.

4. Encompasses the effects of containerization and intermodality on organizational and equipment development; standardization; needs at ports, air terminals, ships and aircraft; and forward movement in overseas theaters.

C. DEFINITIONS

Terms used in this Directive are defined in enclosure 2.

D. POLICY

1. It is DoD policy that DoD Components attain and maintain a container-oriented distribution system of sufficient capability to meet DoD-established mobilization and deployment goals while ensuring commonality and interchangeability of intermodal containers, hardware, and equipment between the Military Services and commercial industry, which collectively constitute the DoD container-oriented distribution system. The container-oriented distribution system must interface with and complement the movement and control of all other noncontainerized DoD cargo.

2. The DoD policy is to rely on the use of intermodal container resources and services furnished by the commercial transportation industry when doing so is responsive to military requirements.

3. Containerized shipment shall be the preferred method, unless cost effectiveness or peculiar shipment requirements are an overriding factor.

E. RESPONSIBILITIES

1. The Under Secretary of Defense (Acquisition) (USD(A)) shall:

a. Coordinate the continued development of the overall DoD program for the container-oriented distribution system.

b. Maintain liaison and coordinate container system development with Federal, executive, and regulatory agencies.

c. Provide policy guidance implementing this Directive.

d. Review, at least annually, the status of each program assigned in enclosure 4 of this Directive.

2. The Organization of the Joint Chiefs of Staff (OJCS) shall provide oversight to the maintenance and improvement of interoperability between the various Service container systems. Service plans that require assistance of, or impact on, the container programs of other Services shall be brought to OJCS Logistics Directorate (J-4) for coordination.

3. The Secretary of the Army, through the Military Traffic Management Command (MTMC), shall manage and monitor the status of intermodal surface containers in common-user service while these containers are in the Defense Transportation System (DTS).

4. The Secretary of the Navy, through the Military Sealift Command (MSC), shall act as DoD agent for procurement of intermodal surface containers for common-user service supporting those DoD Component requirements and capability assessments coordinated through MTMC.

5. The Secretary of the Air Force, through the Military Airlift Command (MAC), shall act as the DoD agent responsible for the procurement of intermodal air containers and for the implementation of a system of airlift intermodal air containers and shelters for the Military Services.

6. The Heads of DoD Components shall:

a. Review, develop, coordinate, and carry out assigned container programs (see enclosure 4).

b. Develop container-oriented distribution system equipment, including doctrine, organization structure, logistic support, and maintenance requirements, and training programs to satisfy Service-unique requirements.

c. Direct container system development to ensure that:

(1) Tasks assigned to the DoD Components are consistent with overall DoD goals.

(2) Satisfactory progress is achieved within identified periods, including the preparation of required progress reports.

(3) Development problems are identified properly, assigned priorities, and followed up until resolved.

(4) Development is within established DoD policy guidance.

(5) There is optimum compatibility with commercial container systems in general use in the industry, and that it is within the packaging policy guidance established by DoD Instruction 4100.14 (reference (c)).

(6) Related phases of research, development, initial procurement, testing and evaluation, production, distribution, logistic support, maintenance, and mobilization planning are coordinated to achieve a balanced program in total system development and integration.

d. Comply with applicable military specifications in packaging and shelter designs.

e. Establish a central point, or points, of contact to address tasks contained in this Directive and to provide advice to the DTFC members on intermodal matters and container system development.

f. Program, budget, and fund programs for container system development consistent with guidance provided by USD(A).

g. Plan and integrate container system actions within and between other Military Departments, DoD Components, and commercial activities.

F. PROCEDURES

1. Containers and associated equipment may be purchased or leased in the following situations:

a. When required to provide a nucleus for use on MSC-controlled ships, or required for long-term use on MSC chartered ships to meet military requirements.

b. When required to provide a nucleus for use in the MAC airlift system.

c. When the equipment is peculiar to the Department of Defense, and unavailable from commercial sources in sufficient time and quantity to meet essential military needs.

d. When the equipment is required to meet the intra-installation requirements of the Military Departments.

e. When the equipment is required to meet contingency or mobilization requirements that cannot be met by containers in common-user commercial service, or to meet overriding security considerations.

f. When satisfactory commercial container service is unavailable at a reasonable cost (see DoD Instruction 4100.33 (reference (d))). For the purposes of this Directive, reasonable cost is defined as a cost not exceeding what commercial carriers charge private shippers.

g. When the equipment is required for essential military requirements other than point-to-point transportation. These purposes include, but are not limited to, the following:

(1) Containers preloaded with military supplies necessary to support rapid deployment forces during contingencies or mobilization.

(2) Containers configured with interior bins to stock spare parts or other supplies.

(3) Containers required to remain in the overseas area for extended periods, either loaded or empty, to meet essential military requirements.

(4) Containers, special-purpose vans, or shelters configured to serve operational requirements for mobile facilities, such as automatic data processing units, repair shops, communications vans, fire direction centers, munitions assembly and storage buildings, and tactical operation centers. Such items shall be procured with other than transportation program funds.

(5) Nontransportation purposes such as temporary storage aboard commissioned Navy ships and short-term (less than 90 days) storage at DoD Component facilities. Containers required for nontransportation purposes shall not be acquired using transportation funds.

2. Containers used in transporting military cargo shall be subject to the following considerations:

a. The need to make optimum use of the MSC-controlled fleet, the U.S. commercial containership fleet, and the MAC airlift fleet to ensure their availability and capability to meet peacetime, contingency, and wartime requirements.

b. The need to make optimum use of organic or controlled military terminals and other facilities, ensuring the readiness of such resources to meet peacetime, contingency, and wartime requirements.

3. The use of foreign-flag carriers for containerized service shall be in accordance with the provisions of 10 U.S.C. 2631 (reference (e)) and DoD Directive 4500.9 (reference (f)). Foreign-flag carriers shall not be used in peacetime for containerized shipments when U.S.-flag breakbulk ships or aircraft are available and are capable of meeting the military requirement.

4. The 20-foot American National Standards Institute (ANSI) and International Organization for Standardization (ISO) container is designated as the primary size for containerized ammunition shipments. This includes the standard MILVAN, seavan, air/surface, seashed, flatrack, and side-door containers of various heights. While larger containers may be used in contingency or mobilization operations for munition movements, the capability of the user to handle and transport these containers shall be the overriding consideration (e.g., availability or capacity of container-handling equipment).

5. Heads of DoD Components are authorized to approve procurement of containers or associated equipment to meet the special needs set forth above, within the foregoing policy guidelines. USD(A) shall be provided information copies of all such procurement or leasing arrangements by the DoD Components for transportation purposes involving quantities of containers or equipment over 100 units.

6. ANSI and ISO container specifications shall be specified to the maximum extent possible in all procurement actions or long-term lease arrangements for tactical shelters or special-purpose vans (DoD Directive 3224.1, reference (g)).

7. To achieve maximum standardization and reduce inefficiencies, DoD Components shall procure only those shelters listed in enclosure 3 that have been approved as part of the DoD Standard Family of Tactical Shelters. Requests for exception to this policy shall be sent through the Joint Committee on Tactical Shelters (JOCOTAS) to the Assistant Deputy Under Secretary of Defense (ADUSD) (Land Warfare) (TWP). JOCOTAS shall review these requests and recommend approval or disapproval action. The TWP, through JOCOTAS, shall control the shelters to be added or deleted from the DoD Family of Standard Tactical Shelters. DoD Components shall keep the JOCOTAS apprised of tactical shelter inventories and movement requirements data that, in turn, may be provided to the Transportation Operating Agencies (TOAs) and DTPC, as required.

8. Logistic support systems, both existing and planned, shall be made to accommodate these DoD policies, and shall include a mix of commercial and DoD assets that function together to provide a source-to-user capability for handling, storing, and transporting containerized and breakbulk shipments.

9. Each DoD Component shall coordinate with other concerned DoD Components in the development of concepts, procedures, software, and hardware that shall be used throughout the DoD system to use the full potential of a container-oriented distribution system. Heavy reliance shall be placed on interservice coordination and awareness of each other's programs and progress.

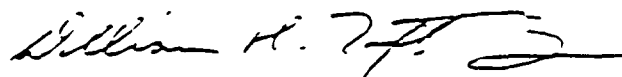
10. Domestic and foreign technological accomplishments and trends shall be considered throughout the development, procurement, and fielding of container equipment. Standardization and interoperability of equipment are vital to the efficiency, effectiveness, and flexibility of the system. There exists a continual requirement to reduce equipment proliferation through Military Service coordination and to realize the economies resulting from standardization.

11. Each DoD Component shall prepare plans for container programs assigned to it in enclosure 4. Each plan shall identify tasks, milestones, funding programs, and priorities. Service plans shall be forwarded to the USD(A) for approval and OJCS (J-4) for review. The status of each plan shall be briefed no less than annually to the DTPC (see DoD Instruction 4500.45 (reference (b))).

12. Maintenance support requirements and responsibilities shall be assigned to achieve long-term reliability and maintainability.

G. EFFECTIVE DATE AND IMPLEMENTATION

This Directive is effective immediately. Forward two copies of implementing documents to the Under Secretary of Defense (Acquisition) within 120 days.



William H. Taft, IV
Deputy Secretary of Defense

Enclosures - 4

1. References
2. Definitions
3. DoD Standard Family of Tactical Shelters
4. Program Description and Planning Responsibilities

REFERENCES, continued

- (e) Title 10, United States Code, Section 2631
- (f) DoD Directive 4500.9, "Transportation and Traffic Management," June 28, 1976
- (g) DoD Directive 3224.1, "Engineering for Transportability," November 29, 1977

DEFINITIONS

1. American National Standards Institute (ANSI) and International Organization For Standardization (ISO) Standards. ANSI and ISO have established standards for the design and construction of containers used in intermodal transportation systems, and have recommended procedures and specifications for their testing. The Department of Defense adheres to those standards to the maximum extent practical. The ANSI and ISO standard nominal exterior dimensions for surface containers are 8 feet wide, 8 to 9 feet 6 inches high, and 5 to 45 feet long. The standard nominal lengths are 20 and 40 feet. Air/surface containers have a nominal width and height of 8 feet; the length may vary from 10 to 40 feet. The standard nominal length is 20 feet.
2. Associated Equipment. Associated equipment includes the chassis, airlift adapter pallets, bogey assembly, and coupler devices, but does not include self-propelled vehicles, railcars, and automotive tractors.
3. Breakbulk Ship. A ship with conventional holds for the stowage of breakbulk cargo, below or above deck, and equipped with cargo-handling gear. Ships also may be capable of carrying a limited number of containers, above or below deck, secured by conventional methods.
4. Defense Transportation System. The collection of transportation facilities and services consisting of military-controlled terminal facilities, MAC-controlled airlift, MSC-controlled sealift, and any other Government-controlled air or surface transportation.
5. Full Containership. A ship specially constructed and equipped to carry only containers without associated equipment, in all available cargo spaces, either below or above deck. The ship may or may not be a self-sustaining containership.
6. Intermodal Container. An article of transport equipment designed to be carried in various ways, designed to optimize the carrying of goods by one or more transportation modes without intermediate handling of the contents, and equipped with features permitting its ready handling and transfer. Containers may have one or more doors, and be open top, refrigerated tank, open rack, gondola, air/surface, or other designs. Included in this definition are modules or clusters that are configured so that they can be coupled to form an integral unit regardless of intention to move singly or in multiplex configurations. For the purpose of this Directive, this definition also includes seasheds and flatracks, although the use of such equipment may require intermediate handling of their contents when transferring from one mode of transportation to another.
7. Joint Committee on Tactical Shelters (JOCOTAS). A Joint Services Committee established to obtain the coordination of all Military Services in developing the DoD Tactical Shelter Program. This committee integrates all tactical shelter requirements from the Military Services and DoD Components.
8. Multipurpose Ship. A ship capable of carrying various combinations of breakbulk cargo, containers, roll-on or roll-off vehicles, and heavy lifts. Ships may be equipped with helicopter platforms, vehicle ramps, and conventional cargo gear. Includes lighter-boarding ship and sea barge ships, both designed

with the capability of loading and offloading with onboard cranes, or in the absence of fixed facilities, for berthing and docking. Barges and lighters are not self-propelled.

9. Non Self-Sustaining Containership. A containership that does not have a built-in capability to load or offload containers, and requires port crane service.

10. Partial Containership. A ship with a portion of its cargo space specially designed and equipped for the exclusive carriage of containers without associated equipment. Remainder of cargo space is available for noncontainerized cargo. The ship may or may not be a self-sustaining containership.

11. Point-To-Point Transportation. As applied to the use of containers, point-to-point transportation is that application when the container is limited to transportation, and normally is stuffed and unstuffed within the free time allowed by the carrier.

12. Self-Sustaining Containership. A containership with shipboard-installed cranes capable of loading and offloading containers without the assistance of port crane service.

13. Shelters or Special-Purpose Vans. A presized, portable structure designed to provide a live-in or work-in capability. This structure may be either rigid or expandable. Insofar as practical, the shelter shall conform to applicable ANSI and ISO container standards.

DOD STANDARD FAMILY OF TACTICAL SHELTERS

<u>Type Shelter (Nomenclature)</u> ¹	<u>Shipping Mode Size (in feet)</u>	<u>Responsible Service</u> ⁴	<u>Remarks</u>
<u>Non-Expandable</u>			
ISO	8x8x10	Marine Corps	EMI ²
ISO	8x8x20	Marine Corps	EMI
ISO	8x8x20	Marine Corps	Side removable for complexing
ISO	8x8x20	Navy	Mobile Facility System
ISO	8x8x20	Army	General purpose
Non-ISO			
S-250()/G	6x6 1/2x7	Army	EMI
Non-ISO			
S-280B/G-C/G	7 1/2x7 1/2x12	Army	EMI
<u>Expandable</u>			
ISO	8x8x20	Army	2:1 one side expandable
ISO	8x8x20	Army	3:1 two side expandable
ISO	8x8x20	Army	7:1 (accordian) 50-ft expand- able
ISO	8x8x20	Army	7:1 expandable building
Non-ISO			
S-530-A/G	7 1/2x7 1/2x12	Air Force	3:1 EMI
Knock down ³ ISO	8x8x20	Marine Corps	Expandable indefinitely in 8x8x20-ft units

¹The S-numeric designation reflects the assigned nomenclature for the shelter. Those shelters designated ISO have been assigned a Federal stock number of NSM 5411.

²Electromagnetic interference.

³Shipped in 4-high stack to form 8x3x20 feet ANSI and ISO compatible unit.

⁴Responsible for research, development, testing, and evaluation.

A. PROGRAM DESCRIPTION

1. The designated DoD Component shall prepare program plans for containerization actions assigned to them for development, integration, and management. As a minimum, the program plan shall contain program direction, guidance, responsibilities, objectives, tasks, priorities, and target dates for program completion. The other DoD Components shall provide assistance and data input when a particular subsystem task falls under their mission responsibility. Test reports and independent evaluations pertaining to the container-oriented distribution system shall be forwarded to the Director of Transportation Policy, Office of the Under Secretary of Defense (Acquisition) (OUSD(A)), for review.
2. Each Military Service is responsible for funding of assigned programs. OUSD(A) shall assist the Services in establishing funding priorities for accomplishing assigned program tasks, and shall monitor the programs' line items in the DoD budget.
3. Program plans prepared in accordance with this Directive shall be updated annually by the responsible DoD Component as of December 31, and forwarded to the Director of Transportation Policy, OUSD(A), within 90 days following the cutoff date.
4. The DoD Component assigned specific programs for management shall provide briefings annually to the Director of Transportation Policy, OUSD(A), and to the members of the DTPC. Periodic updates may be requested by the chairman.

B. PLANNING RESPONSIBILITIES

<u>PROGRAM TITLE</u>	<u>RESPONSIBLE DoD COMPONENT</u>
Air Movement Plan	Department of Air Force
Containerized Ammunition Distribution Plan	Department of Army (AMC)
Seashed Program Management Plan	Department of Navy
Offshore Discharge of Containers/ Logistics over the Shore (OSDOC/LOTS) Program Management Plan	Departments of Army and Navy
Container Systems Hardware Status Report	Department of Army (AMC)
Container Requirements and Availability Study	Department of Army (MTMC)

APPENDIX 2
INVENTORY OF DOD-OWNED ISO CONTAINERS
AND TACTICAL SHELTERS

APPENDIX 2

INVENTORY OF DOD-OWNED* ISO CONTAINERS
AND TACTICAL SHELTERS

<u>Type</u>	<u>Quantity</u>
 <u>ARMY</u>	
Dry Cargo Container (Surgeon General; contract to be awarded)	2,368
General Cargo MILVAN	2,141
Ammunition Restraint MILVAN (includes 249 new 8'X8.5'X20')	4,268
Refrigerated Container	641
	<hr/>
TOTAL ARMY	9,418
 <u>AIR FORCE</u>	
Flatrack	3
Side-Opening Container (367 delivered; contract for 850 to be awarded)	1,217
	<hr/>
TOTAL AIR FORCE	1,220

*ISO serial numbers issued by MTMC's Joint Container Control Office, as of April, 1988, as required by Title 49, Code of Federal Regulations, Parts 450-453. Only containers and shelters conforming to ISO standards are included. Also, inventory listings are not necessarily complete. For example, no ISO tactical shelters are listed for the Army and the Air Force.

Source: Joint Container Control Office, Military Traffic Management Command, Tobyhanna, PA.

APPENDIX 2, Continued

<u>Type</u>	<u>Quantity</u>
<u>MARINE CORPS</u>	
Platform Shipping Container (Open-top)	692
Half High	210
Rigid General Purpose Shelter	918
10' EMI Shelter	224
20' EMI Shelter	68
Knockdown Shelter	710
	<hr/>
TOTAL MARINE CORPS	2,822
 <u>NAVY</u>	
Refrigerated Container	156
Bulk Tricons	575
Configured Tricons	243
20' Bulk Standard	2,065
20' Configured Standard	942
Dry Shipping Container	4,942
Tactical Shelter 1:1	1,375
Tactical Shelter 2:1	326
Tactical Shelter 3:1	269
Radar System Shelter	17
	<hr/>
TOTAL NAVY	10,910

APPENDIX 2, Continued

<u>Type</u>	<u>Quantity</u>
MILITARY SEALIFT COMMAND	
Flatrack Container	28
Dry Cargo Shipping Container	7,303
Refrigerated Container	708
Diesel Clip-on Units	3
	<hr/>
TOTAL MSC	8,042
GRAND TOTAL	32,412

ACRONYMS

AAR	Association of American Railroads
ACI	Automated Carrier Interface
ACDS	Automated Cargo Documentation System
AE	Marine Corps Assault Echelon
AFCSDG	Air Force Container System Development Group
AFCSS	Army in the Field Container System Study
AFISDG	Air Force Intermodal System Development Group
AFOE	Marine Corps Assault Follow-On Echelon
ALOC	Air Line of Communication
ALS	Amphibious Logistics System
ALSA	Amphibious Logistics Support Ashore
AMC	Army Materiel Command
ANSI	American National Standards Institute
AOA	Amphibious Objective Area
APC	American President Companies
APD	American President Domestic
APL	American President Lines
APOD	Aerial Port of Debarkation
APOE	Aerial Port of Embarkation
AR	Army Regulation
ASMSA	Army Strategic Mobility System Assessment
CAA	U.S. Army Concepts and Analysis Agency
CADS	Containerized Ammunition Distribution System
CAEMS	Computer-Aided Embarkation Management System
CATS	Containerized Ammunition Transportation System Study
CCP	Container Consolidation Point
CCS	USCENTCOM's Cargo Containerization System
CG	U.S. Coast Guard
CHAP	Container-Handler All Purpose
CHE	Container Handling Equipment
CINC	Commander-in-Chief
CMMS	Congressionally Mandated Mobility Study
CMOS	Air Force Cargo Movement Operations System
CMS	MTMC's Container Management System
CMS/TOMS	Navy's Cargo Management System/Terminal Operations Management System
CNA	Center for Naval Analysis
CNO	Chief of Naval Operations
COCADA	Containerized Cargo Distribution Analysis
COD	Crane on Deck
COMMZ	Communications Zone
CONDA	Container Oriented Network Distribution Analysis
CONEX	Container Express
CONUS	Continental United States
COSSA	Containerized Shipment and Storage of Ammunition
COTS	Container Offloading and Transfer System
CRAS	Container Requirements and Availability Study
CSS	Combat Service Support
CSSA	Combat Service Support Area, or Containership Cargo Stowage Adapters
CSS/CG	Container System Standardization/Coordinating Group
CSUS	Containership Strike Up System

CVSS	Container Vessel Support System
DA DCSLOG	Department of the Army, Deputy Chief of Staff for Logistics
DALO-TSM	Strategic Mobility Division, Department of the Army, Deputy Chief of Staff for Logistics
DARCOM	Department of the Army, Materiel Development and Readiness Command
DASPS-E	Department of the Army, Port System Enhanced
DG	Defense Guidance
DLA	Defense Logistics Agency
DLSIE	Defense Logistics System Information Exchange
DOD	Department of Defense
DODD	Department of Defense Directive
DODI	Department of Defense Instruction
DOT	U.S. Department of Transportation
DTIC	Defense Technical Information Center
DTPC	Defense Transportation Policy Council
EDI	Electronic Data Interchange
ELCAS	Elevated Causeway
EMI	Electro-Magnetic Interference
FASTALS	Force Analysis Simulation of Theater Administration and Logistics Support
FLS	Field Logistics System
FM	Field Manual
FMFM	Fleet Marine Force Manual
FORSCOM	U.S. Army Forces Command
FSS	Fast Sealift Support(ship)
GAO	General Accounting Office
GSE	General Support Equipment
IDA	Institute for Defense Analysis
IMAPS	MAC's Integrated Military Airlift Planning System
IRSKIT	Internal Restraint System Kit
ISO	International Standards Organization
JCSG	Joint Container Steering Group
JDA	Joint Deployment Agency
JISG	Joint Intermodal Steering Group
JLOTS	Joint Logistics Over the Shore
JLRB	Joint Logistics Review Board
JOCOTAS	Joint Committee on Tactical Shelters
JOPS	Joint Operations Planning System
JPAM	Joint Program Assessment Memorandum
JTF	Joint Task Force
LACH	Lightweight Amphibious Container Handler
LACV-30	Lighter Air Cushion Vehicle, 30-Ton
LASH	Lighter Aboard Ship
L-CAC	Land Craft-Air Cushioned
LOGMARS	Logistics Applications of Automated Marking and Reading Symbols
LOTS	Logistics Over the Shore
LSPC	Logistics Systems Policy Committee
MAC	Military Airlift Command
MACOM	Major Army Command
MACTDS	Marine Automated Cargo Throughput Documentation System
MAPS II	MTMC's Mobility Analysis and Planning System
MAJCOM	Major Air Force Command

MARAD	U.S. Maritime Administration
MCCDC	Marine Corps Combat Development Command
MCCP	Marine Corps Capabilities Plan
MCCS	Marine Corps Container System
MCESS	Marine Corps Expeditionary Shelter System
MCRDAC	Marine Corps Research and Development Acquisition Council
MEB	Marine Expeditionary Brigade
MEF	Marine Expeditionary Force
MERADCOM	Army Mobility Equipment Research and Development Command
MEU	Marine Expeditionary Unit
MFS	Marine Corps Mobile Facility System
MHE	Materials Handling Equipment
MIDAS	Model for Intertheater Deployment by Air and Sea
MILVAN	Military Van
MIS	Management Information System
MLSF	Mobile Logistics Support Force
MOTSU	Military Ocean Terminal, Sunny Point, NC
MPF	Maritime Prepositioned Force
MPS	Maritime Prepositioned Ship
MSC	Military Sealift Command or Mobile Straddle Crane
MSNAP	Merchant Ship Naval Augmentation Program
MTMC	Military Traffic Management Command
MTMC/TEA	Military Traffic Management Command, Transportation Engineering Agency
NAVAIR	Naval Air Systems Command
NAVFAC	Naval Facilities Engineering Command
NAVMAT	Naval Materiel Command
NAVSEA	Naval Sea Systems Command
NAVSUP	Naval Supply Command
NCEL	Naval Civil Engineering Laboratory
NMCB	Naval Mobile Construction Battalion
NSIA	National Security Industrial Association
NSN	National Stock Number
NTPF	Near Term Prepositioned Force
NWHC	Naval Weapons Handling Center
NWP	Naval Warfare Publication
OASD - I&L	Office of the Assistant Secretary of Defense for Installations and Logistics
OCONUS	Outside Continental United States
OJCS (J-4)	Organization of the Joint Chiefs of Staff, Logistics Directorate
ONR	Office of Naval Research
OP-42	Chief of Naval Operations, Strategic Sealift Division
OPLAN	Operations Plan
OSDOC	Offshore Discharge of Containerships
OTH	Over-the-Horizon
PACAF	U.S. Air Force Pacific
PALCON	Pallet Container
PDIP	Program Development Increment Package
PHIBOPS	Amphibious Operations
POD	Port of Debarkation
POE	Port of Embarkation
POL	Petroleum, Oil, Lubricants

PM AMMOLOG	Army Project Manager for Ammunition Logistics
PM ACODS	Project Manager for the Army Container Oriented Distribution System
POM	Program Objective Memorandum
QUADCON	Quadruple Container
RADIDSIM	Rapid Inter-theater Deployment Simulation Model
RIMS	Revised Inter-theater Mobility Study
RRF	Ready Reserve Fleet
RTCH	Rough Terrain Container Handler
SEACOP	MSC's Sealift Contingency Planning System
SITAP	Simulation for Transportation and Planning (Model)
SLOC	Sea Line of Communication
SMRP	Strategic Mobility Requirements Program
SPOD	Seaport of Debarkation
SPOE	Seaport of Embarkation
TAA	Total Army Analysis
TACMEMO	Marine Corps Tactical Memorandum
T-ACS	Auxiliary Crane Ship
T-AKR	Auxiliary Cargoship, Roll-on/Roll-off
TCDF	Temporary Container Discharge Facility
TCDM	Transportation Control and Movement Document
TEU	Twenty-foot Equivalent Unit
TOA	Transportation Operating Agency or Table of Allowance
TOE	Table of Organization and Equipment
TOSCA	Test of Containerized Shipments of Ammunition
TPFDD	Time-Phased Force and Deployment List
TRADOC	Army Training and Doctrine Command
TRICON	Triple Container
TSC	Transportation Systems Center
TUCHA	Type Unit Data File
UDC	Unit Deployment by Containership
UE	Unit Equipment
UMMIPS	Uniform Materiel Movement and Issue Priority System
UNREP	Underway Replenishment
USAFE	U.S. Air Force Europe
USAREUR	U.S. Army in Europe
USCENTCOM	United States Central Command
USCINCLANT	Commander-in-Chief, U.S. Atlantic Command
USCINCTrans	Commander-in-Chief, U.S. Transportation Command
USTRANSCOM	U.S. Transportation Command